PHYSICS ABSTRACTS

SECTION A

of

SCIENCE ABSTRACTS

SECTION A, PHYSICS

SECTION B, ELECTRICAL ENGINEERING

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PRINCIPAL CONTENTS

January 1949

		PAGE
51	**MATHEMATICS**	7
52	**ASTRONOMY. ASTROPHYSICS. GEODESY**	8
53	**PHYSICS**	10
53.08	Errors and corrections	10
530.1	**Fundamentals**	10
530.12	Relativity	10
530.14	Quantum theory. Theory of particles	11
531	**General mechanics. Mechanics of solids**	13
531.7	**Mechanical measurements**	13
532	**Mechanics of fluids**	14
532.6	**Capillarity**	16
532.7	**Kinetic theory of liquids**	16
533	**Mechanics of gases**	17
533.7	**Kinetic theory of gases**	19
534	**Vibrations. Acoustics**	19
535	**Optics. Radiation. Spectra**	22
535.31	Geometrical optics	23
535.33/.34	Spectra	24
535.37	Luminescence. Raman effect	26
535.4	Diffraction	28
535.5	Polarized light	29
535.8	Optical instruments	29
536	**Heat**	29
536.2	Conduction. Heat transfer	29
536.42	Change of state	30
536.48	Low-temperature phenomena	31
536.58	Thermoregulation	31
536.6	Calorimetry	31
536.7/.8	**Thermodynamics**	31
537	**Electricity**	32
537.1	**Theory. Electrons**	32
537.2	**Electrostatics. Dielectrics**	32
537.3	**Electric conduction. Currents**	33
537.311.33	Semi-conductors	33
537.312.62	Superconductivity	33
537.52	**Electric discharges**	
537.531	**X-rays**	
537.533/.534	**Cathode rays. Positive rays**	
537.54	**Discharge tubes. Counters**	
537.56/.58	**Ionization. Thermionics**	
537.591	**Cosmic rays**	
538	**Magnetism**	
538.3/.5	**Electromagnetism. Electrodynamics**	
538.6	**Magnetic effects**	
539.13	**Molecular structure**	
539.15	**Atomic structure. Isotopes**	
539.16	**Radioactivity. α-, β- and γ-rays**	
539.17	**Nuclear reactions**	
539.18	**Atom and molecule beams. Mesons. Neutrons**	
539.2	**Structure of solids**	
539.3/.8	**Elasticity. Strength. Rheology**	
541	**PHYSICAL CHEMISTRY**	
541.121/.123	**Phase equilibrium**	
541.124/.128	**Reaction kinetics**	
541.13	**Electrochemistry**	
541.14	**Photochemistry**	
541.183	**Adsorption**	
541.4/.6	**Chemical structure**	
542.9	**Chemical processes**	
543/545	**Chemical analysis**	
548	**CRYSTALLOGRAPHY**	
548.7	**Molecular and X-ray crystallography**	
55	**GEOPHYSICS**	
551.5	**Atmosphere. Meteorology**	
57/59	**BIOLOGY**	
61	**Medical science. Human physiology**	
666	**Glass. Ceramics**	
77	**PHOTOGRAPHY**	

The headings printed in bold type will be found in the text. The others may be located by their U.D.C. number.

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Mechanical testing
Non-destructive testing
Industrial radiography
Corrosion
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Photocells
Thermionic tubes
Cathode-ray tubes
X-ray tubes
Induction accelerators
Cyclotrons
Amplifiers
Radio-wave propagation
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[*Continued on page 3 of*

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Geophysics
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Botany
Zoology

convenience the first decimal point is always , but it is essential that it should remain im- on the reader's mind. The fact that all the s are in reality decimal fractions less than unity nes the arrangement of the numbers in numerical e. Thus 526 (meaning .526) precedes 53 (meaning scending order.

To indicate a work dealing with two or more subjects independently, the numbers corresponding to these subjects are connected by + signs. Thus

531.754 + 536.62 Measurement of density and of specific heat

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Thus

537.531 X-rays
535.4 Diffraction
548.0 Crystals
537.531 : 535.4 : 548.0 X-ray diffraction by crystals

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place: 551.524.2(73) Temperature maps of the United States
language: 548.55 = 3 Monocrystalline tungsten wires (in German)

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51 Mathematics
52 Astronomy. Geodesy
53 Physics
54 Chemistry
55 Geology. Geophysics
57/59 Biological Sciences
61 Medical Sciences
66/68 Industrial Technology
77 Photography

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51 MATHEMATICS

511 ARITHMETIC AND THEORY OF NUMBERS

512 ALGEBRA

513 GEOMETRY

514 TRIGONOMETRY

515 DESCRIPTIVE GEOMETRY. PROJECTION. PERSPECTIVE

516 ANALYTICAL GEOMETRY. CO-ORDINAT

517 ANALYSIS. CALCULUS. THEORY OF FU TIONS

518 GRAPHS. METHODS OF CALCULATI NOMOGRAPHY. TABLES

519 MATHEMATICAL STATISTICS. PRO BILITY. CALCULUS OF VARIATIO THEORY OF GROUPS

52 ASTRONOMY. GEODESY

521 THEORETICAL ASTRONOMY
- .03 Astrophysics
- .04 Astrochemistry
- .1/.9 Celestial mechanics

522 PRACTICAL ASTRONOMY
- .1 Observatories. Equipment for expeditions
- .2 Telescopes
- .3 Meridian instruments. Meridian circles
- .4 Other observation instruments
- .5/.6 Auxiliary instruments and apparatus
- .7 Spherical astronomy
- .9 Sources of error and corrections

523 CELESTIAL BODIES (except Earth)
- .1 The Universe. Cosmology
- .2 Solar system
- .3 The Moon
- .4 Planets and their satellites
- .5 Meteors
- .6 Comets
- .7 The Sun
- .8 Stars
- .81 Position. Parallax. Distance
- .82 Magnitude. Colour. Visibility
- .83 Proper motion. Rotation
- .84 Variable stars. Binaries. Novae
- .85 Clusters. Nebulae. Galaxies
- .87 Spectra
- .877 Physical and chemical constitution
- .88 Constellations
- .89 Catalogues
- .9 Transits. Occultations

524 COLLECTED TABLES AND ATLASES

525 THE EARTH
- .1 Constants
- .11 Mass. Gravitation
- .12 Density. Elasticity
- .13 Dimensions
- .14 Shape
- .15 Solar distance. Solar parallax
- .2 Physics of the Earth from the astronom point of view. Cosmic influences
- .3 Orbit and rotation
- .4 Geographical co-ordinates
- .5 Seasons
- .6 Tides
- .7 Terrestrial atmosphere

526 GEODESY. SURVEYING
- 526(4/9) Geodetic surveys and reports of diffe regions
- 526.1 Theory and determination of the shap the Earth
- .2 Base measurement and apparatus
- .3 Geodetic triangulation and levelling
- .4/.5 Triangulation calculation
- .6 Astronomical determination of g graphical co-ordinates
- .7 Gravity measurements
- .7(4/9) Gravity surveys of different regions
- .8 Cartography. Maps and models
- .9 Topographical surveying and levelling
- .9(4/9) Topographical surveys of different regi

527 NAVIGATION. NAUTICAL AST NOMY

529 CHRONOLOGY. MEASUREMENT TIME
- .1 Sidereal day and solar day
- .2 Eras. Years. Months. Weeks
- .3/.5 Calendars
- .7 Horology. Measurement of time

53 PHYSICS

Special Analytical Subdivisions

In the section 53 Physics, special analytical subdivisions can be attached where no appropriate main subdivisions exist, as follows:—
- .01 Theory and nature of the phenomenon
- .02 General laws
- .03 Production and causes of the phenomenon
- .04 Effects
- .06 Application
- .07 Apparatus
- .08 Measurements
- .081 Units. Constants. Dimensions
- .082/.083 Principles and methods of measurement
- .084/.087 Instruments and apparatus. Recording
- .088 Errors and corrections
- .09 Dependence on various agencies

530.1 GENERAL PRINCIPLES
- .12 Relativity
- .14 Atomism
- .145 Quantum theory. Wave mechani
- .15 Action and reaction. Hysteresis
- .16 Causality and probability

531 GENERAL MECHANICS. MECHAN OF SOLID AND RIGID BODIES
- .01 Mathematical theory

531.1 Kinematics. Geometry of motion
- .11 Principles

531.14 Translation. Sliding
.15 Rotation
.18 Relative motion
.19 Statistical mechanics

531.2 **Statics. Forces. Equilibrium**
.22 Composition and resolution of forces
.23 Moments
.24 Centre of gravity
.25 Graphical and analytical statics. Stress analysis
.26 Attraction. Potential

531.3 **Dynamics**
.31 Principles
.311 Newton's laws
.312 D'Alembert's principle
.313 Virtual velocities
.314 Least action
.32/.33 Particle dynamics
.35 Motion under central forces
.36/.38 Motion of rigid bodies

531.4 **Work. Friction**

531.5 **Weight. Gravitation. Ballistics**
.51 Laws of universal attraction
.52 Falling bodies
.53 Pendulum theory
.55/.57 Motion of projectiles

531.6 **Mechanical energy. Momentum. Impact**

531.7 **Measurement of geometric and mechanical quantities**
.71 Length
.72 Surface
.73 Volume
.74 Angles
.75 Mass. Density
.76 Time. Velocity. Acceleration
.77 Angular velocities
.78 Force. Work. Pressure

531.8 **Theory of machines**

532 **MECHANICS OF FLUIDS. HYDROSTATICS. HYDRODYNAMICS**

532.1 **Hydrostatics**
.12 Elasticity. Compressibility
.13 Viscosity
.14 Density
.2 Equilibrium of liquids
.3 Equilibrium of immersed and floating bodies

532.5 **Hydrodynamics**
.51 Motion of liquids
.52 Conditions of motion
.522 Orifices
.525 Nozzles. Jets
.527 Vortices
.528 Cavitation
.53 Weirs. Waterfalls
.54 Pipes. Siphons. Canals. Rivers
.55 Energy losses
.57 Flow measurement
.58 Pressure exerted by a liquid in motion. Resistance to motion of bodies
.59 Liquid waves

532.6 **Surface tension. Capillarity**
.61 Surface tension
.62 Thin films
.63 Capillarity
.64 Angle of contact
.69 Surface activity. Oiliness. Wetting

532.7 **Kinetic theory of liquids. Osmosis. Solution**
.71 Osmosis
.72 Diffusion
.73 Solution
.74 Association
.77 Physical properties of solutions
.78 Crystallization. Supersaturation

533 **MECHANICS OF GASES. AERODYNAMICS**

533.1 **Properties of gases**
.12 Density
.15 Diffusion
.16 Viscosity

533.2 **Elasticity. Compressibility. Liquefaction. Gas mixtures**
.22 Boyle's law
.24 Liquefaction
.275 Humidity. Hygrometry

533.4 **Barometers**

533.5 **Vacuum pumps. Vacuum technique**

533.6 **Aerodynamics. Aeronautics**
.01 Theory
.011 Motion of the air
.013/.015 Dynamics of aircraft
.07 Wind tunnels
.61/.64 Theory of balloons, kites and airships
.65/.69 Theory of aircraft and aircraft elements

533.7 **Kinetic theory of gases. Equations of state**

534 **ACOUSTICS. VIBRATIONS**
.01 Theory of vibrations
.1 Vibration of bodies. Excitation and recording of vibrations
.2 Propagation of vibrations
.22 Velocity of propagation
.23 Transmission
.24 Reflection
.25 Refraction
.26 Diffraction
.27 Polarization
.32 Quality. Pitch. Timbre
.321.9 Ultrasonic vibrations
.37 Damping of vibrations
534.4 Analysis and synthesis of sound
.5 Composition of vibrations
.6 Acoustical measurements
.7 Physiological acoustics. Hearing
.83 Noise. Noise measurement. Noise abatement
.84 Architectural acoustics. Reverberation. Echo
.85 Acoustics of gramophone records
.86 Broadcasting. Sound films
.87 Acoustic signalling
.88 Sound ranging

535 **OPTICS**
.1 **Theory of light**
.2 **Radiation. Photometry**
.214 Radiation pressure
.215 Photo-electricity
.22 Velocity of light
.23 Energy of radiation. Black-bodies
.24 Photometry. Intensity of light
.243 Spectrophotometry

535.3 **Reflection. Refraction. Emission. Absorption. Spectra**
.31 Geometrical optics
.312 Reflection. Plane mirrors
.313 Curved mirrors. Aberration
.314 Refraction
.315 Prisms
.316 Thin lenses
.317 Thick lenses
.32 Refractive indices. Dispersion
535.33 Spectra in general. Emission spectra
.34 Absorption
.342/.343 Absorption spectra
.345 Transparent bodies
.347 Dichroism. Pleochroism
.35 Excitation. Extinction
.36 Diffusion
.37 Luminescence. Fluorescence. Phosphorescence
.375.5 Raman effect
.39 Vitreous reflection. Metallic reflection

535.4 **Interference. Diffraction**
.41 Interference
.42 Diffraction
.43 Scattering. Turbidity. Tyndall effect

535.5 **Polarization. Double refraction**
.51 Production of polarized light
.52 Optical surfaces and axes
.54 Chromatic polarization. Comparators. Crystals
.55 Double refraction produced by strain
.56 Optical rotation
.563 Rotatory power
.568.1 Polarimeters
.58 Rotary dispersion

535.6 **Colour theories. Colour measurement**

535.7 **Physiological optics. Vision**

535.8 **Optical systems**
.81 Optical glass. Lenses and prisms
.82 Microscopes
.83 Spectacles. Telescopes
.86 Camera lucida. Periscopes
.87 Mirrors. Reflectors
.88 Projection apparatus
.89 Light sources

536 **HEAT. THERMODYNAMICS**
.1 Theory
.2 Conduction. Convection
.3 Heat radiation
.4 Action of heat on bodies
.41 Dilatation
.42 Change of state. Fusion. Boiling. Vapour pressure
.44 Critical points
.45 Incandescence. High-temperature effects
.46 Combustion. Flames
.48 Low-temperature phenomena
536.5 Temperature measurement and control. Thermometers. Thermostats
.6 Quantity of heat. Calorimetry
.62 Calorimetry
.63 Specific heat
.65 Latent heat
.66 Heat of reaction

536.7 **Thermodynamics**
.71 Change of state. Equations of state
.72 First law. Mechanical equivalent
.73 Second law
.74 Thermodynamic temperature
.75 Entropy
.77 Thermodynamic potential. Phase rule
.78 Joule–Thomson effect
.79 Third law
.8 Theory of heat engines

537 **ELECTRICITY**
.1 **Theory**
.12 Electrons
.13 Protons. Positrons

537.2 **Electrostatics**
.21 Field. Potential. Charge
.22 Electrification. Distribution of charge
.226 Dielectrics
.1 Permittivity
.3 Dielectric loss
.228.1 Piezo-electricity
.2 Electrostriction
.3 Electric double refraction
.4 Kerr effect
.5 Stark effect
.24 Charge on small particles

537.3 **Electric conduction. Currents**
.311 Conductivity. Resistance. Impedance
.33 Semiconductors
.4 Contact resistance
.6 A.c. resistance. Impedance
.62 Skin effect

537.312.5 Photoconductivity
.6 Temperature-variation
.62 Superconductivity
.32 Thermo-electricity
.36 Elektrokinematics. Electrophoresis

537.5 **Electric discharges. Radiations**
.52 Discharges

.531 **X-rays**

537.533 **Cathode rays**
.71 Reflection
.72 Refraction
.73 Diffraction
.74 Scattering
.75 Absorption. Range
.8 Secondary radiation
.92 Ionization

537.534 **Anode rays. Positive rays**
.71 Reflection
.72 Refraction
.73 Diffraction
.74 Scattering
.75 Absorption. Range
.8 Secondary radiation

537.54 Discharge tubes. Counter tubes
.56 Ionization of gases
.57 Ionization of non-electrolytic liquids and solids
.58 Thermionics

537.59 **Cosmic rays**

537.7 **Electrical measurements**
For measurements in electrical engineering see 621.317
.71 Units
.72 Measurement of various electrical quantities
.74 Instruments

538 **MAGNETISM. ELECTROMAGNETISM**
538.1 **Theory**

538.2 **Magnetic properties. Magnetization**
.21 General
.22 Properties of substances
.23 Hysteresis
.24 Magnetization. Demagnetization

538.3 **Electromagnetism. Electrodynamics**

538.5 **Induction. Alternating currents**
.52/.53 Induction. Induction coils
.54 Eddy currents
.55 Alternating currents
.56 Oscillations. Waves
.566 Propagation
.3 In ionosphere
.569 Absorption

538.6 **Effects of or on magnetic fields**
.61 Optical
.63 Electrical
.65 Mechanical
.652 Magnetostriction
.66 Thermal

.7 **Terrestrial magnetism**

539.1 **ATOMS. MOLECULES**

539.11 **Theory of solids**

539.13 **Structure of molecules**
.132 Intramolecular mechanics. Quantum theory of molecules
.133 Molecular dimensions. Moments

539.15 **Structure of atoms**
.152.1 Nucleus. Quantum theory of nucleus
.153 Distribution of electrons. Quantum theory of the atom

539.154	Atomic constants. Nuclear charge. Moments
.155	Atomic mass
.2	Isotopes
.4	Absolute values. Loschmidt's number
.156	Intra-atomic mechanics
539.16	**Radioactivity**
.08	Measurements of radioactivity
.162	Disintegration theory
.163	Radioactive elements
.1	Decay constants
.2	Radiations. Spectra
.164	Alpha rays
.165	Beta rays
.166	Gamma rays
539.167	**Artificial radioactivity**
539.17	**Artificial disintegration of atoms. Artificial nuclear transmutation**
539.18	**Other particles**
.181	Molecular and atomic beams
.185	Neutrons
539.2	**STRUCTURE OF SOLIDS**
.211	Surface texture
.213	Amorphism. Vitreous state
.214	Plasticity
.215	Particles. Powders
539.216	Lamellar structure. Fibres
.217	Porosity. Permeability
.23	Thin films
.24	Microstructure
.25	Ultramicroscope examination
.26	X-ray examination
.27	Corpuscular ray examination
539.3/.8	**ELASTICITY. STRENGTH. RHEOLOGY**
539.3	**Elasticity. Deformation**
.31	Theory. Internal stresses
.32	Elastic moduli
.37	Deformation in general
.38	Forms of deformation. Yield point. Elastic hysteresis
539.4	**Strength**
.01	Theory. Influences on strength
.42	Tensile strength. Breaking strength
.43	Fatigue. Creep
539.5	**Material properties influencing deformability**
.501	Rheology
539.6	**Intermolecular forces**
.61	Adhesion. Cohesion
.62	Friction
539.8	**Other mechanical effects**
.893	Very high pressure

54 CHEMISTRY

541	**THEORETICAL CHEMISTRY**
.1	Physical chemistry
.11	Thermochemistry
.12	Chemical mechanics
.121/.123	Equilibrium
.124/.127	Reaction kinetics
.128	Catalysis
.13	Electrochemistry
.14	Photochemistry
.18	Colloids. Disperse systems
.183	Adsorption
.2	Atomic theory
.4	Chemical combination. Compounds
.5	Valency. Bonds
.6	Chemical structure
.62	Isomerism
541.63	Stereochemistry
.64	Polymerism
.65/.69	Relation between chemical structure and physical properties
542	**EXPERIMENTAL CHEMISTRY**
.1/.8	Apparatus. Physical processes
.9	Chemical processes
543/545	**ANALYTICAL CHEMISTRY**
546	**INORGANIC CHEMISTRY**
547	**ORGANIC CHEMISTRY**

548 CRYSTALLOGRAPHY

548	**CRYSTALLOGRAPHY**
.0	General. Physical properties
.1	Geometry
.2	Crystal aggregates
.3	Crystal chemistry
.4	Irregularities
.5	Growth of crystals
548.6	Pseudomorphism
.7	Molecular structure
.71	Lattice systems
.73	X-ray examination
.74	Electron diffraction
.75	Infra-red examination
549	**MINERALOGY**

55 GEOLOGY. GEOPHYSICS

550.3	**GEOPHYSICS**
.312	Gravity. Isostasy
.34	Seismology
.36	Terrestrial thermodynamics
.37	Terrestrial electricity
.38	Terrestrial magnetism
.4	Geochemistry
.8	Applied geology. Prospecting
.9	Geological time
551	**GENERAL GEOLOGY. METEOROLOGY. STRATIGRAPHY**
.1	General structure of the earth
.2/.3	Geodynamics
.4	Surface of the globe
.46	Oceanography
551.5	**Atmosphere. Meteorology**
.50	Practical meteorology. Observations. Instruments. Forecasting

551.51 Structure and mechanics of the atmosphere
.510.3 Density
.4 Composition
.5 Structure
.535 Ionosphere
.513 Mechanics. Thermodynamics
.515 Disturbances. Storms

551.52 Radiation. Temperature
.54 Atmospheric pressure
.55 Wind
.57 Humidity. Cloud. Precipitation
.58 Climatology
.59 Cosmic influences. Visibility. Optic electrical and acoustic phenomena

57/59 BIOLOGICAL SCIENCES

574/578 **GENERAL BIOLOGY**
575.11 Genetics
576.3 Cytology
.8 Microbiology. Bacteriology
577.1 Biochemistry

578 **BIOLOGICAL TECHNIQUE**

591 **GENERAL ZOOLOGY**
.1 Animal physiology
.11 Blood. Circulation
.175 Muscle
.18 Nerves. Electrophysiology. Sensitivity

61 MEDICAL SCIENCES

612 **HUMAN PHYSIOLOGY**
.84 Vision
.85 Hearing

614 **HYGIENE**
.485 Disinfection by ultra-violet rays
.7 Contamination of air, ground, water
.8 Protection

615 **THERAPEUTICS**
.831 Light therapy
.832 Heat therapy. Diathermy
.84 Electrotherapy
.849 Radiotherapy

616 **PATHOLOGY**
–07 Diagnosis
–073.75 Radiography

66/68 INDUSTRIAL TECHNOLOGY

662.6/.9 Heating and fuel
666 Glass. Ceramics
669 Metallurgy
674 Wood
676 Paper

677 Textiles
678 Rubber
.7 Artificial rubber
679.5 Plastics
681 Instrument making

77 PHOTOGRAPHY

771.31 Cameras
.351 Lenses
.53 Sensitive materials
772 Processes
778.3 Scientific photography

778.33 Radiography
.35 Aerial photography
.37 High speed photography
.5 Kinematography
.6 Colour photography

MATHEMATICS 51

512.889 : 517.944

1. Differential equations invariant with respect to the Lorentz group. HARDTWIG, E. *Ann. Phys., Lpz.* (*Folge* 6) **2** (*Nos* 5–6) 273–85 (1948) *In German.*—The transition from one inertial system to another is effected by transforms leaving invariant an equation $x_1^2 + x_2^2 + x_3^2 - x_0^2 = 0$ (Lorentz group), representing a degenerate conic. Transforms leaving invariant a non-degenerate conic, i.e. $\pm\kappa(x_1^2 + x_2^2 + x_3^2 - x_0^2) + 1 = 0$, suggest themselves. Physically, this means the replacement of Euclidean space by a space of constant, +ve or −ve, curvature. Lie's group theory enables all equations and diff. equations invariant against a given group to be found. This is shown in the paper in the Euclidean case on Maxwell's equations and the wave equation. The wave equation so obtained exactly corresponds to that following from Dirac's theory, though it involves ordinary functions only instead of matrices and operators. Lie's theory also makes it clear why Schroedinger's relativization of his wave equation was found to fail: he failed to draw up his equations in the way postulated by the appropriate "extension" of the Lorentz group. A.

517.43 : 621.3.011/.012

2. A method for the approximate solution of problems in the operational calculus. MARSILII, P. *Elettrotecnica*, **35**, 258–63 (*June* 10–25, 1948) *In Italian.*—Laplace transforms are calculated approx. by a series method; 4 examples are given and an upper limit for the error is evaluated. L. S. G.

517.5 : 535.12 : 534.213

3. The saddle point method in the vicinity of a pole with wave optics and acoustics applications. OTT, H. *Ann. Phys., Lpz.* (*Folge* 5) **43** (*Nos* 6–7) 393–403 (1943) *In German.*—Generalizes a method by Pauli [Abstr. 250 (1939)]; the solution leads to generalized Fresnel integrals. The field of a Hertz dipole in a plane of given conductance is calculated by the method. The occurrence of Zenneck surface waves is investigated. An application to the propagation of sound above water is included. V. W. R.

517.613

4. On a function associated with the logarithmic derivative of the gamma function. HARTREE, D. R., AND JOHNSTON, S. *Quart. J. Mech. Appl. Math.*, **1**, 29–34 (*March*, 1948).—The real part of $\psi(k) - \log k + 1/2k$ is evaluated and tabulated as a function of $1/k^2$ over the range $-1{\cdot}00(0{\cdot}01)$, $+1{\cdot}00$ for $1/k^2$. Here $\psi(k) = \Gamma'(k)/\Gamma(k)$. Values are given to 8 decimal places. The tables are useful in wave-mechanical problems concerning the structure of many-electron atoms [Abstr. 2918 (1928)]. L. S. G.

517.9

5. On a property common to differential and integral operators. YVON, J. *C.R. Acad. Sci., Paris*, **223**, 311–12 (*Aug.* 12, 1946) *In French.*—Functions of the operators x and $-i\hbar\partial/\partial x$ are considered. If G is a differential operator, a function, $g(x,p) = \exp(-ipx/\hbar)G\exp(ipx/\hbar)$, is considered, where p is a parameter. The conditions that G be self-adjoint is expressed as a simple condition on g. A self-adjoint integral operator is also studied. L. S. G.

517.941.9 : 517.912.2 : 621.395.61

6. Microphonic functions. YAKOVLEV, A. I. *Dokl. Akad. Nauk SSSR*, **59** (*No.* 4) 651–4 (1948) *In Russian.*—Abstr. 197 B (1949).

517.941.91 : 530.145.6

7. On some problems of proper functions relating to the regular hexagon. WASSERMANN, G. *C.R. Acad. Sci., Paris*, **223**, 537–9 (*Oct.* 7, 1946) *In French.*—The solutions of the wave equation, $\partial^2\psi/\partial x^2 + \partial^2\psi/\partial y^2 + \lambda\psi = 0$, such that either ψ or $\partial\psi/\partial n$ vanishes on a regular hexagon are obtained. Explicit expressions are given for the corresponding proper values. L. S. G.

517.947.44

8. A boundary problem involving the wave equation for a cylinder. SMOLITZKY, K. L. *C.R. Acad. Sci. URSS*, **54** (*No.* 7) 583–6 (1946) *In French.*—The equation, $\dfrac{\partial^2 u}{\partial t^2} = \dfrac{\partial^2 u}{\partial \rho^2} + \dfrac{1}{\rho}\dfrac{\partial u}{\partial \rho} + \dfrac{\partial^2 u}{\partial z^2} - \dfrac{n^2 u}{\rho^2}$, is solved in the domain, $t \geqslant 0$, $-\infty < z < \infty$, $\rho \leqslant 1$, subject to the initial conditions $u = \partial x/\partial t = 0$, when $t = 0$ and $\varepsilon^{in\theta}u = f(t, z)\varepsilon^{in\theta}$ for $\rho = 1 (n = 0, 1, 2, \ldots)$.

517.947.44

9. On the periodic solutions of non-linear partial differential equations. ZHABOTINSKI, M. E. *Dokl. Akad. Nauk SSSR*, **56** (*No.* 5) 469–72 (1947) *In Russian.*—Deals with distributed autonomous auto-oscillatory systems, where the non-linear and dissipative terms are small of the same order and the remaining terms may be written as a linear self-adjoint operator. The 1-dimensional problem having been treated by Witt [*J. Tech. Phys.*, **4**, 144 (1934)] and Strelkov [*Tech. Phys. of USSR*, **2**, 232 (1935)], the author extends the method to the 3-dimensional one, the stationary solutions of which are found for given boundary conditions by the Sturm–Liouville theorem. The stability of the solutions is discussed on Ljapunov's principles. M. G. G.

517.949.718

10. Finite difference formulae for the square lattice. BICKLEY, W. G. *Quart. J. Mech. Appl. Math.*, **1**, 35–42 (*March*, 1948).—Approx. formulae for derivatives and integrals of a function of 2 variables are given, including the cases ∇^2 and ∇^4. The form as well as the magnitude of the dominant error terms is considered. It is suggested that the formulae are suitable in the final stages of a computation, and their use may add to the accuracy without further subdivision of the mesh length. For related work see Abstr. 509, 1695 (1947). L. S. G.

518.5

11. The four-counter scheme of solution of Dirichlet's problem by means of punched-card machines. AKUSHSKY, I. J. *C.R. Acad. Sci. URSS*, **54** (*No.* 8) 659–62 (1946) *In English.*—Previous work [*ibid.*, **52** (*No.* 5) (1946)] is continued, and Dirichlet's problem for a rectangular domain is solved in detail.

Four points are calculated simultaneously, there being 4 points on every card. The scheme, when suitably modified, may be applied to an arbitrary domain. L. S. G.

518.5 : 621.317.75

12. Electrical analyser of oscillating curves based o Vercelli's method. LOVERA, G. *Nuovo Cim.*, **5**, 150- (*June*, 1948) *In Italian.*—Abstr. 129 B (1948).

ASTRONOMY . ASTROPHYSICS . GEODESY 52

522.61 : 771.319

13. Recent advances in astronomical camera design. LINFOOT, E. H. *Photogr. J.*, **88 B**, 58–64 (*May–June*, 1948).—A historical survey on lens systems used for astronomical photography is given. The Schmidt camera is fully discussed and modifications described. A modern technique for making corrector plates of moderate size and recent advances in camera design are given. A.

523.11 : 523.877

14. Determination of the ages of stars, a contribution to Jordan's cosmology. TEN BRUGGENCATE, P. *Nachr. Wiss. Göttingen* (*No.* 1) 29–30 (1945) *In German.*—See Abstr. 1391 (1948).

523.165

15. Observations on the variable source of cosmic radio frequency radiation in the constellation of Cygnus. BOLTON, J. G., AND STANLEY, G. J. *Aust. J. Sci. Res. A*, **1**, 58–69 (*March*, 1948).—The size and celestial co-ordinates of the source and the variations over a frequency range from 60 to 200 Mc/s were determined. The frequency spectra were compared with those of galactic and solar radiation. The position of the source was found to be in a region of relatively low stellar density and not coinciding with an outstanding stellar object. A discussion of limits of distance and possible nature of the source is given. A.

523.25/.26

16. Recent theories about the origin of the solar system. TER HAAR, D. *Science*, **107**, 405–11 (*April* 23, 1948).—Surveys existing theories and announces some results of a detailed investigation by the author of the properties of a rotating solar envelope. It is reported that a quantitative analysis of condensation processes is able to explain the chief physical differences between the inner and outer planets. R. A. N.

523.5

17. Bečvář's meteor stream. CLEGG, J. A., HUGHES, V. A., AND LOVELL, A. C. B. *J. Brit. Astr. Ass.*, **58**, 134–9 (*May*, 1948).—A short account is given of radar observations made on Dec. 22–3, 1947. The hourly rate, and right ascension and declination were measured.

523.5

18. Radio echo and visual observations of the B.elid meteor streams, 1946–47. LOVELL, A. C. B., AND PRENTICE, J. P. M. *J. Brit. Astr. Ass.*, **58**, 140–3 (*May*, 1948).

523.5 : 536.42

19. Thermal constants of meteorites. LINK, F., AND PETRÀCEK, O. *Čas. Pést. Mat. Fys.*, **72** (*No.* 3) 147–54 (1947) *In French.*—In meteoric phenomena different phases intimately connected with thermal constants may be distinguished. These constants may be determined in lab. tests. Different types of visibility have been established from statistics comprising nearly 200 observed meteors which enable various hypothese concerning the density of high atmospheric layers t be checked. From the ignition and extinction of th meteors, above all the fainter ones, the type c visibility can be determined, whether they consist c stone or iron. This offers the alternative of a therma analysis in cases where spectral analysis is impossibl owing to insufficient brightness. A

523.53 : 551.510.535 : 621.396.

20. The theory of the radio detection of meteor MANNING, L. A. *J. Appl. Phys.*, **19**, 689–99 (*Aug* 1948).—The methods of observation are describe both for "bursts" of signal strength and "whistles caused by reflection of radio waves from meteori ionization. Consideration is given to the geometry c reflection, and it is shown that meteoric velocity an range can be accurately determined by combined puls and whistle observations. The possibility of dete mining the direction and position of a meteor path b observations at 3 receiving locations is examined, an a method for interpreting such data is developed. A investigation is made of the fraction of meteo capable of producing bursts, and the important effec of the meteoric radiant is emphasized. A

523.671 : 535.338.

21. The 4 050 Å group in the spectra of the nucl of comets 1946a and 1946b. TCHENG, M.-L., AN FEHRENBACH, C. *C.R. Acad. Sci., Paris*, **226**, 1345- (*April* 26, 1948) *In French.*—Measures of emission line in spectrograms of these comets, taken with a sl spectrograph at Haute-Provence and compared wit Herman's lab. wavelengths of CH_2, confirm th presence of this molecule and Swings's suggeste identification of the 4 050 band. D. L.

523.671 : 535.338.

22. Comparison of the 4 050 Å group of comet 1948 with the bands attributed to CH_2. FEHRENBACH, C *C.R. Acad. Sci., Paris*, **227**, 519–21 (*Sept.* 6, 1948) *French.*—Reproductions of microphotometer tracing of the spectra of 1948g and CH_2 (Lab. source), with list of wavelengths and intensities in each, give strikin confirmation of CH_2 as the origin of cometa emissions in the region 3 970–4 125 Å [cf. Abstr. 2 (1949)]. Components at 4 013 and 4 068 are al normally strong, and probably due to some oth superposed emission. D. L.

523.72 : 523.745 : 621.396.812.5.029.6

23. The present status of microwave astronom WILLIAMSON, R. E. *J. Roy. Astr. Soc. Can.*, **42**, 9–3 (*Jan.–Feb.*, 1948).—The technique of astronomy radio frequencies is compared with that at optic frequencies. Existing observations of cosmic noi are critically compared; all that can be said is that t best measures indicate radiation temperatures of t same order as the electron temperature in interstell

space. Solar noise is divided into the minimum radiation from the "quiet" sun, corresponding to an effective temperature of 10^4–10^6 degrees according to frequency, and the bursts of radiation associated with sunspots. The observations of cosmic noise cannot yet distinguish with certainty between the suggested origins in thermal emission from interstellar dust, in free-free transitions of interstellar electrons, and in Thomson scattering. The origin of "quiet" solar noise is doubtless the corona, but the "disturbed" noise may be due to gyro-magnetic emission or to plasma oscillations. A. HU.

523.74 : 525.24 : 550.385

24. Solar streams of corpuscles and their relation to geomagnetic storms. CHAKRABARTY, S. K. *Mon. Not. Roy. Astr. Soc.*, **106** (*No.* 6) 491–9 (1946).—The equations of the stream curves of particles emitted by solar flares are obtained as a function of velocity and co-ordinates of origin. A narrow beam emitted from a point source can produce a terrestrial magnetic storm of given duration if the velocity distribution of the particles is continuous over a range which determines the duration. Velocities are calculated for some recent great storms. The direction of emission must be far from radial in some cases. A. HU.

523.752 : 523.78

25. Wavelengths of chromospheric lines from spectra taken during the total solar eclipse of 1936 June 19th. FRACASTORO, M. G. *Atti R. Accad. d'Italia* (*R.C. Classe Sci. Fis., Mat. Nat.*) (*Ser.* 7) **1** (*No.* 6) 134–57 (1940) *In Italian.*—The wavelength of 339 emission lines has been measured on chromospheric spectra taken with a slit grating spectrograph in Littrow mounting. This was fed by a single celostat, through an objective, $f = 5$ m, and gave a dispersion of 5 Å/mm. Line displacements and heights of the emission levels are discussed. G. R.

523.752 : 523.78

26. Equivalent width and intensity of chromospheric lines observed at the solar eclipse of 19th June 1936. FRACASTORO, M. G. *Atti R. Accad. d'Italia* (*R.C. Classe Sci. Fis., Mat. Nat.*) (*Ser.* 7) **2**, 979–1029 (1940) *In Italian.*—Absolute intensity measurements of chromospheric lines on slit spectra taken with a grating spectrograph. Standardization of plates by step-wedge and sunlight and by absolute standard lamps. Intensities of lines in multiplets discussed. G. R.

523.755.035/.036 : 522.61

27. Colour index and temperature of the solar corona. RIGHINI, G. *Atti R. Accad. d'Italia* (*Mem. Cl. Sci. Fis. Mat. Nat.*) **14** (*No.* 8) 75–93 (1943) *In Italian.*—The selective absorption and reflectivity of lenses, filters and mirrors of a long focus eclipse camera were measured. Colour index and temperature of the corona photographed with this equipment are obtained. A possible explanation of the observed fall of the temperature in the middle corona is proposed. G. R.

523.77

28. The continuous spectrum of the solar corona. RIGHINI, G. *Atti R. Accad. d'Italia* (*R.C. Classe Sci. Fis., Mat. Nat.*) (*Ser.* 7) **1** (*No.* 12) 716–45 (1940) *In Italian.*—Intensity measurements on two spectra of the corona taken with prism spectrographs. The spectral curve at a distance 1·6′ from the sun's limb is obtained in absolute units. Plate standardization with lamps at known temperature. Features of the coronal spectrum and its colour temperature are discussed. G. R.

523.77 : 535.334

29. The emission spectrum of the solar corona. RIGHINI, G. *Atti R. Accad. d'Italia* (*Mem. Cl. Sci. Fis. Mat. Nat.*) **14**, 113–57 (1943) *In Italian.*—A quantitative analysis of the solar corona is made through the measurement of the equivalent width of 13 emission lines in two spectra. The ratio "metal ions/electrons" is found to be 10^{-7}. Isophotic lines for the Fe XIV line 5 303 are given. The wavelength of a new coronal line is measured. G. R.

523.774

30. The absorption properties of the solar photosphere. CHALONGE, D., KOURGANOFF, V., AND PELTEY, H. *C.R. Acad. Sci., Paris*, **223**, 272–4 (*Aug.* 5, 1946) *In French.*—A continuation of previous work [*C.R. Acad. Sci., Paris*, **223**, 132 (1946)]. The negative hydrogen ion is the only cause of opacity in the photosphere between 5 000 and 6 500 Å.U. and the coefficients of Chandrasekhar [Abstr. 2246 (1946)] are quite accurate in this region. Atomic hydrogen is an important absorbent below 3 700 Å.U. L. S. G.

523.775 : 545.82

31. Quantitative spectral analysis of the solar atmosphere. UNSÖLD, A. *Nachr. Wiss. Göttingen* (*No.* 1) 34–5 (1945) *In German.*—Attempts have been made to improve the accuracy of the quantitative analysis of the solar atmosphere. Comparison of different excitation and ionization stages of the same elements gives the mean ionization level to be 8·33 V. 85% of the free electrons arise from Mg, Si and Fe. The cosmic frequency-distribution of the principal elements is given. B. A.

523.775 : 545.82

32. Quantitative analysis of the spectrum of an active protuberance. UNSÖLD, A. *Nachr. Wiss. Göttingen* (*No.* 1) 36–7 (1945) *In German.*—The absolute intensities of the lines in the λ range 3 234–5 876 Å of the spectrum of an active protuberance have been measured. By means of quantum-theoretical calculations or experimentally determined transition probabilities the number of emitting atoms can be obtained. The frequency ratio of the elements H and He on the sun is given by $\log(\mathrm{H/He}) = 0{\cdot}7 \pm 0{\cdot}5$. The anomalous strength of the He lines in the spectra of giant stars is not due to a preponderance of He, but to super-excitation phenomena. B. A.

523.821.4 : 521.036

33. The determination of the scale of stellar temperatures by visual photometry. GAUZIT, J., AND PROISY, P. *C.R. Acad. Sci., Paris*, **226**, 1431–2 (*May* 3, 1948) *In French.*—Announces results of visually measured colour temperatures of 146 bright stars of different spectral types. The method used enables a direct comparison to be made with a standard lamp and the atmospheric absorption has been measured on each observing night. For A_0 type stars a resulting temperature of 17 400°K is deduced, which

is in close agreement with recent modern photographic determinations. E. G. M.

523.83 : 521.11

34. Contribution to Lindblad's theory on the motion of masses in the dynamics of stellar systems. COUTREZ, R. *Stockholms Obs. Ann.*, **15** (*No.* 3) 38 *pp.* (1947) *In French.*—A mathematical study of stellar systems under the hypothesis of space motion, but also introducing differential rotation. Variations due to motion and density are examined and later the effects of perturbations are considered. Conditions leading to instability are given and the types of waves likely to produce ejection are described. E. G. M.

523.852.32 : 521.11

35. On the dynamical theory of spiral structure. Comparison between theory and observation. LINDBLAD, B. *Stockholms Obs. Ann.*, **15** (*No.* 4) 52 *pp.* (1948) *In English.*—Previous work on the formation of spiral nebulae is summarized [see *Stockholms Obs. Ann.*, **13** (*No.* 10) 1941; **14** (*No.* 1) (1942)]; asymptotic orbits for a rotating spheroid, and various types of deformation and density waves are considered. Resonance between waves and individual particle motions is studied, and conditions for the development of spiral structure are discussed. The theory, applied in a detailed study of several nebulae, accounts for the shape of the spiral arms and dark lanes. It is suggested that the spiral structures in *M*81 and *M*33 have developed in times ~ one revolution of these systems. A study of *NGC*1300 leads to the suggestion that normal spirals originate from Riemann deformation waves, whereas barred spirals result from density waves of low frequency. R. A. N.

523.875 : 523.8

36. Analysis of the Hertzsprung–Russell diagram the region of the white dwarfs. SCHATZMAN, *Ann. Astrophys.*, **10** (*No.* 1) 19–28 (1947) *In French.* Configurations with appreciable H-contents are co sidered, and luminosities and effective temperatur are calculated. Curves of constant H-content a traced in the Russell diagram. R. A.

525.24 : 550.384/.386 : 523

37. A possible influence of the moon on recurre geomagnetic activity. WULF, O. R., AND NICHOLSO S. B. Letter in *Phys. Rev.*, **73**, 1204–5 (*May* 15, 194 —The authors draw attention to a possible correspo dence between a recurrence in magnetic activity a the moon's declination. Reference is made to diagram in an earlier paper by the authors [*Pu Astr. Soc. Pacif.*, **60**, 37 (1948)] giving the variati of the magnetic character figures with sunsp numbers from 1930 to 1933. Certain well defin series of maxima in the magnetic curve show interva of approximately 27 days. The authors suggest th the moon, as well as the sun, may be a factor determining when such 27-day series occur. V. C. A.

525.75 : 551.593

38. The origin of the night sky light. BATES, D. *Mon. Not. Roy. Astr. Soc.*, **106** (*No.* 6) 509–14 (1946). Evidence from the intensity, altitude, space and tim variations, magnetic correlations and spectrum of t night-sky light points to a partial origin in incide charged particles. It is suggested that the action of t Störmer current allows these particles to approa the earth at low latitudes. A. H

PHYSICS 53

53.088 : 519.24

39. The numbers of observations needed in experiments leading to a *t*-test of significance of a mean or the difference of two means. SILLITTO, G. P. *Research, Lond.*, **1**, 520–5 (*Aug.*, 1948).—The numbers of observations needed in experiments requiring statistical methods for their interpretation depend on the risks which can be tolerated of reaching two distinct kinds of erroneous conclusions. For the frequently occurring experiments involving simple comparisons of the mean of a sample with a standard value or with the mean of another sample, tables are presented showing the numbers of observations needed in relation to the tolerable risks of the two kinds of error, the precision of the experimental work, and the magnitude of the difference which the experiment is required to detect, if it exists. The use of these tables is illustrated by examples. A.

FUNDAMENTALS 530.1

530.12

40. Calculation of gravitational effects in Born–Infeld's theory. FISHER, I. S. Letter in *J. Exp. Theor. Phys.*, **18**, 668–9 (*July*, 1948) *In Russian.*

530.12 : 513.813 : 539.152

41. The metric of space and mass deficienc MOSHARRAFA, A. M. *Phil. Mag.*, **39**, 728–38 (*Sep* 1948).—A generalized form of the Riemannian met is introduced into the theory of relativity; the wor line of a charged particle is shown to be a geodesic, a the equations of motion of the particle are obtaine The mass of the particle is obtained as a function its potential energy. The mass deficiency of nuc is explained as arising from the presence of th charged components in the nuclear field. T potential of nuclear fields is determined from exa mass measurements for 37 elements. Calculations effective radii agree with results obtained by Gam from radioactive data. The mass of an electron i nuclear field indicates that β-disintegration is mo akin to emission of field energy than to parti ejection. The mass of a positron is very small in t neighbourhood of a nucleus. A curve is drawn fr the data to represent the growth of potential w atomic number, Z, reaching a value of about 20 M at $Z = 81$.

530.12 : 530.1

42. Theory of elementary particles. SINDO, *Mem. Fac. Engng Hokkaido Univ.*, **8**, 125–40 (*O* 1947) *In Japanese.*—In micro-phenomena the fluence of the observer's system does not seem to

correctly assessed in relativistic treatment, so that the 4-dimensional time-space representation might have to be altered, it being "absolute" instead of "relative" with respect to the observer's system. The author's suggestion for an improved field theory introduces a method termed "latticization" and the main results are, briefly: there are limiting values to the energy of a free elementary particle, and the self-energy of an electron and nucleon becomes finite. It may be expected that the difficulty of the divergence existing in the present theory will hereby disappear. A.

530.12 : 530.145.6

43. Group theoretical discussion of relativistic wave equations. BARGMANN, V., AND WIGNER, E. P. *Proc. Nat. Acad. Sci., Wash.*, **34**, 211–23 (*May*, 1948).—The classification of the unitary representations of the Lorentz group corresponds to a classification of all possible relativistic equations, apart from the particular structure of these equations. The infinitesimal operators which generate the representations are discussed in detail and also invariants derived from them which can be used to characterize the representations or the wave-equations. Differential equations are given, corresponding to each irreducible representation. G. J. K.

530.14

44. Scalar mesostatic field with consideration of gravitation effects. FISHER, I. S. *J. Exp. Theor. Phys.*, **18**, 636–40 (*July*, 1948) *In Russian.*—The scalar mesostatic field of a point source is studied, considering the space-time curvature due to the field itself. For the field with $\kappa = 0$ an exact solution of Einstein's equation is given. It is shown that at small distances from the source the effects of gravitation are so considerable as to cause material changes in the behaviour of the meson field. In particular, the total energy of the static field becomes logarithmically divergent. A.

530.14 : 537.122

45. On solutions of the Schwarzschild–Nordström type for a point charge without singularities. (Classical electron theory). SHIROKOV, M. F. *J. Exp. Theor. Phys.*, **18**, 236–42 (*Feb.*, 1948) *In Russian.*—The gravitational and electromagnetic fields of the problem of a point charge e_0 may be represented by the general solution of Einstein's gravitational and the electromagnetic equations involving a suitably chosen function $\mu(r)$, and the fields so described contain no singularities over the whole range of r from 0 to ∞. For a certain choice of $\mu(r)$ the Einstein–Rosen solution, free of discontinuities, and valid for a neutral particle of mass m, is obtained. For an electron the solving function takes the form $\mu = -2\log(1 - \varepsilon^{kr})$, where $k = 1/r_0$, a constant. This solution is regular, and yields the well-known relation $r_0 = e_0^2c^2/m$ determining the particle mass. Thus r_0 plays the role of the classical electron radius. It is shown that the electron has the correct relativistic 4-vector of energy-impulse and that its energy-impulse tensor satisfies Laue's theorem. A.

530.14 : 538.312

46. A note on the theory of the meson field. FLÜGGE, S. *Ann. Phys., Lpz.* (*Folge* 5) **43** (*Nos* 6–7) 573–7 (1943) *In German.*—When the formal analogy between meson field and Maxwell's electrodynamic field theory is carried through for heavy particles (n, p), it is usual to let them be represented by point sources. This restriction is dropped by the author with a view to nuclear physics applications, and the concept of space charge density is transferred from Maxwell's to meson field theory. The results are discussed. V. W. R.

530.145

47. On the quantization of field theories derived from higher order Lagrangians. DE WET, J. S. *Proc. Camb. Phil. Soc.*, **44** (*Pt* 4) 546–59 (1948).—The field equations are put into Hamiltonian form and then Einstein–Bose and Fermi–Dirac quantization are carried out. It is shown that the quantization is relativistically invariant and consistent with the field equations. The Hamiltonian is generally different from the integral of the 4–4 component of the energy momentum tensor. [For a different approach to the present work see Abstr. 2036 (1946)]. L. S. G.

530.145

48. Second order equation for a Pauli–Dirac particle. RADICATI, L. A. *Nuovo Cim.*, **5**, 173–80 (*June*, 1948) *In Italian.*—The second order wave equation for the Dirac–Pauli particle in case of stationary motions is important for the problem of the magnetic moment of the deuteron. It is shown that the Pauli term in the 1st order equation may be accounted for, by adding to the operator representing the mechanical and electric moment, two terms which can be referred to as magnetic and electric dipole moment, viz. $\lambda/c\beta\sigma_0\mathbf{H}$, $i\lambda/c\beta\mathbf{E}$; then the Dirac–Pauli equation takes the form of a 2nd order equation, which permits a very simple interpretation of the total energy of the particle, as arising from the interaction of the various moments (i.e. mechanical, electric, and dipole) with each other. The approximate Pauli equation for the large components, exact up to terms of order $(v/c)^3$ is given; in this case also, one can see how different are the relativistic corrections arising from the charge magnetic moment and the intrinsic one. A.

530.145 : 531.19 : 533.7

49. Quantum statistics. WISNIEWSKI, F. J. *C.R. Acad. Sci., Paris*, **223**, 313–15 (*Aug.* 12, 1948) *In French.*—The equation of Fokker is generalized; and it is shown that the Maxwell, Planck and Fermi distributions are solutions of this equation in space of the Gibbs–Boltzmann statistics. L. S. G.

530.145.1

50. The radiation principle. TIKHONOV, A. N., AND SAMARSKY, A. A. *J. Exp. Theor. Phys.*, **18**, 243–8 (*Feb.*, 1948) *In Russian.*—The general principle of radiation is formulated for the wave equation $\Delta v + k^2v = -F(M)$, $[M = (x, y, z)]$ in that sense that the solutions satisfying the principle appear as limiting solutions (for $t \to \infty$) of Cauchy's problem with zero initial conditions for the corresponding equation of oscillations, i.e. $\Delta u - 1/c^2\partial^2u/\partial t^2 = -F(M)\varepsilon^{-i\omega_0 t}$, $(k^2 = \omega_0/c^2)$. It is shown that in infinite space the method described leads to solutions satisfying Sommerfeld's condition. A.

530.145.6

51. The correspondence between classical and wave mechanics: time-independent integrals of the second order. FAURE, R. *C.R. Acad. Sci., Paris*, **225**, 1279–80 (*Dec.* 22, 1947) *In French.*—The problem previously

discussed [*C.R. Acad. Sci., Paris*, **224**, 797 (1947)] is extended to cases where the integral of the motion contains terms linear in the momentum. G. J. K.

530.145.6

52. On mean values and the probability law in wave mechanics. BASS, J. *C.R. Acad. Sci., Paris*, **227**, 112–14 (*July* 12, 1948) *In French.*—A function formally equivalent to a probability density function in phase space is derived on the method of characteristic functions. G. J. K.

530.145.6 : 517.91

53. Catination [enchainement] and quantization; a generalization of a theorem of Darboux applied to the spherical rotator. VIGUIER, G. *C.R. Acad. Sci., Paris*, **227**, 504–6 (*Aug.* 30, 1948) *In French.*—Continuation of Abstr. 56 (1949). A relation is indicated between quantization of the wave-equation and a method of solving this equation due to Darboux involving a sequence of solutions. G. J. K.

530.145.6 : 517.942.82

54. A new method of formulating and solving wave-mechanical problems. I. KALLMANN, H., AND PÄSLER, M. *Ann. Phys., Lpz.* (*Folge* 6) **2** (*Nos* 5–6) 292–304 (1948) *In German.*—The solution of a wave equation may be easier in terms of the Laplace transform of the equation. The formulation of the boundary conditions is given and the process is illustrated by the solution of the radial equation of the hydrogen atom. The transform is a 1st-order differential equation. The standard results for both the discrete and continuous spectrum are obtained by the examination of the solution of this equation. G. J. K.

530.145.6 : 517.942.82

55. A general solution of the H-atom with arbitrary initial conditions using the Laplace transformation, and its physical significance. II. KALLMANN, H., AND PÄSLER, M. *Ann. Phys., Lpz.* (*Folge* 6) **2** (*Nos* 5–6) 305–20 (1948) *In German.*—Solutions of the radial equation of the H-atom are obtained using the Laplace transform with more general boundary conditions than in I [Abstr. 54 (1949)]. The harmonic oscillator problem is also solved by the same method. G. J. K.

530.145.61 : 517.923.4

56. The Schrödinger equation for a linear harmonic oscillator. VIGUIER, G. *C.R. Acad. Sci., Paris*, **226**, 1958–9 (*June* 14, 1948) *In French.*—The relation of this equation to a Riccati equation is discussed. G. J. K.

530.145.61/.63 : 537.212

57. The various representations of a homogeneous electric field in wave mechanics. SAUTER, F. *Ann. Phys., Lpz.* (*Folge* 5) **43** (*Nos* 6–7) 404–16 (1943) *In German.*—The homogeneous electric field is represented by a vector potential function instead of the usual scalar potential. The following advantages are found. (1) The wave equation is easily solved and leads to simpler functions than the corresponding Schrödinger method. (2) Very simple matrix elements occur with perturbation calculations. With the Dirac equation very simple matrices are again obtained, but the time and probability relations become rather complicated. No advantage is therefore gained by using vector potential representation of the electric field with the Dirac equation. V. W. R.

530.145.63 : 512.

58. On the determination of matrices satisfying system of relations in meson theory. GARNIER, *C.R. Acad. Sci., Paris*, **223**, 539–40 (*Oct.* 7, 1946) *French.*—The theorem of complete reducibility established for the system of Hermitian matri $A_1, \ldots, A_n$, satisfying the relations, $A_iA_jA_k + A_kA_jA_i = A_i\delta_{jk} + A_k\delta_{ji}$, where $i, j, k = 1, \ldots$ The systems arising in meson theory are obtained putting $n = 4$ and $n = 5$ L. S

530.145.63 : 517.

59. On the relation of the eigenvalues of Heisenberg *S*-matrix to stationary states. MEIXNER *Z. Naturforsch.*, **3a**, 75–8 (*Feb.*, 1948) *In German.*- new proof is given of the continuity relation betw the eigenfunctions of the discrete and continu spectrum of the wave-equation for a central force. depends on the properties and expansion of the Gr function of the equation. G. J

530.145.63 : 537.11

60. On spin and radiating power. WESSEL, *Ann. Phys., Lpz.* (*Folge* 5) **43** (*Nos* 6–7) 565–72 (19 *In German.*—The radiating power is a 4-vec consisting of velocities, accelerations and changes acceleration, which reacts on the motion of a chan particle like its own radiation. The author attem to introduce this radiation reaction power knc from the electron theory into quantum mechan The equations of motion of a particle due to vector are analogous to its motion under influenc electron spin in the Dirac theory apart from discrepancies: (1) The equations of velocity differ a dimensionless factor; (2) periodic motion is cc pared with an aperiodic motion; (3) the energy of spin electron is constant (this is overcome by add the equivalent of the emitted energy to the mass). V. W

530.145.63 : 537.

61. Two-component equation arising from the D equation of the electron. BECKER, R. *Nachr. W Göttingen* (*No.* 1) 20–8 (1945) *In German.*

530.16 : 531.6 : 536

62. Mechanisable energy and entropy. MERCIER *J. Phys. Radium.* (*Sér.* 8) **9**, 39–45 (*Feb.*, 1948) *French.*—It is shown that entropy is analogous certain aspects to such magnitudes as mass, electr charge or momentum. Although it is usually poss only to speak of the entropy of a body, any quan of heat may be regarded as the product of a temp ture T and a certain entropy. In a reversible tra formation this entropy is able to pass from one b to another without modification. In all cases reversible or irreversible changes the change entropy may be evaluated from $\int \frac{dQ}{T}$, where T is temperature of the body, provided account is ta of all the heat exchanges and in particular those ari more or less directly from the "transformable" "mechanisable" energy. This latter energy arises fi the natural tendency towards the uniformizatior the variables in any system, and is not entirely yiel up externally as the system tends towards a stat equilibrium, some appearing as heat and warming system with a natural increase in entropy. F.

530.162 : 533.723

63. On the statistical reversibility of Brownian movement. YAGLOM, A. M. *Dokl. Akad. Nauk SSSR*, **56** (*No.* 7) 691–4 (1947) *In Russian.*—The Brownian movement is considered as a special Markov process in a $2n$-dimensional space of co-ordinates and velocities. The assumed positive density of the transition probability satisfies the Fokker–Planck equation. From an assumed stationary distribution the uniqueness of which is established, and which defines the thermodynamical probability, the *a posteriori* probability of a given distribution can be found and this is used to define the statistical reversibility. The conditions for a system to be statistically reversible are derived and the identity of the results of this theory for special cases with results obtained in different ways by Onsager Eisenhart, and Einstein–Smoluchovski is shown. M. G. G

GENERAL MECHANICS MECHANICS OF SOLIDS 531

531.01 : 531.31/.32–1 : 517.944

64. Physical curves in generalized fields of force. KASNER, E., AND DE CICCO, J. *Proc. Nat. Acad. Sci. Wash.*, **34**, 169–72 (*April*, 1948).—Geometrical and transformation properties are considered, of the solutions of differential equations which can describe particle paths in a generalized field of force, depending on the direction of motion as well as position, either in free motion or under constraint where the total normal constraint is a constant multiple of the normal force component. G. J. K.

531.224.8 : 539.4.25 : 539.382/.384

65. Considerations on Mohr's theory of failure. KASTNER, H. *Öst. Ingen. Arch.*, **2** (*No.* 4) 298–309 (1948) *In German.*—A discussion is given of the forces brought into play by the deformation of a solid body. Mathematical expressions for the criterion of failure, particularly the Mohr stress circles, are discussed in detail, for the various types of force involved, i.e. tension, compression and shear. G. O. B.

531.258

66. Boussinesq's problem for a rigid cone. SNEDDON, I. N. *Proc. Camb. Phil. Soc.*, **44** (*Pt* 4) 492–507 (1948). —A detailed account is given of the distribution of stress in a semi-infinite elastic medium with a Poisson ratio 0·25 when its boundary is indented by a rigid right circular cone whose axis is normal to the original surface of the medium. The components of stress are calculated at various points in the interior of the elastic body, and the results of the calculations are embodied in a set of tables which enable the stress components at any point to be obtained by interpolation. The variation of the various components of stress in certain planes parallel to the undeformed free surface of the medium is illustrated graphically. The principal shearing stress is tabulated in a similar fashion, and the contours of equal principal shearing stress drawn to show graphically the distribution of stress in the neighbourhood of the apex of the cone. The application of these results to the normal penetration of a solid medium by a rigid conical-headed punch of the type used in hardness tests is considered briefly. A.

531.259 : 548.0

67. Three-dimensional stress distributions in hexagonal aeolotropic crystals. ELLIOTT, H. A. *Proc. Camb. Phil. Soc.*, **44** (*Pt* 4) 522–33 (1948).—The conditions for equilibrium under elastic stress are formulated, and solutions are found in terms of two "harmonic" functions. It is shown that in the case of axially symmetrical stress systems the solution may be expressed in terms of the third-order differential coefficients of a single stress function. The solutions for an isotropic medium may be deduced as a special case. The problems of nuclei of strain in such a hexagonal solid are solved, and the results for Zn and Mg contrasted with those for an isotropic solid. A.

531.314 : 536.75

68. The dissipation of internal energy in linear dynamical systems. WINTNER, A. *Phil. Mag.*, **39**, 722–8 (*Sept.*, 1948).—A criterion is obtained for the stability of a system which is of Hamilton's canonical type, but which contains time explicitly. The proof of the criterion involves the replacement of the oscillation theorem by a simpler argument based on a differential relation expressing the dissipation of energy. L. S. G.

531.539.2

69. On the coupling of two resonating pendulums. SALCEANU, C., AND BORNEAS, M. *C.R. Acad. Sci., Paris*, **226**, 874–6 (*March* 15, 1948) *In French.*—The problem solved is to determine from given initial conditions the motion of 2 equal pendulums connected by an elastic wire neglecting friction. The period of amplitude variation is expressed in terms of the system constants, and the result for very loose coupling is shown to agree with a formula established in a previous note [Abstr. 3066 (1947)], and with experimental data. [See also Abstr. 3617 (1948)]. G. G.

MECHANICAL MEASUREMENTS 531.7

531.714.7 : 621.317.083.7

70. A remote reading dial micrometer. COYLE, M. B., AND HAYNES, F. G. *J. Sci. Instrum. Phys. Ind.*, **25**, 275–6 (*Aug.*, 1948).—A method is described by which the reading of a dial micrometer, or other dial instrument, may be transmitted electrically to a remote indicating or recording station. This is effected by attaching to the instrument a small detecting unit of simple construction. The modification does not interfere with direct reading of the instrument. A.

531.76 : 778.37 : 621.317.39

71. The photographic measurement of short time intervals by means of synchronous motors. FINK, L. *Arch. tech. Messen, Issue* 155 (*Ref. V*142–12) *T*67 (*June*, 1948) *In German.*—The simple device described consists of a synchronous motor whose axle carries a suitably marked or perforated disc. Time intervals down to 0·0002 sec can be measured by photographing the position of the marks. The precautions which must be observed to obtain successful exposures are discussed. H. K. H.

531.771 : 621.317.39

72. High-speed revolution counter. KAUFMAN, A. B. *Electronics*, **21**, 80–2 (*Sept.*, 1948).—Abstr. 116 B (1949).

531.787.2

73. Bourdon gauges. WUEST, W. *Arch. tech. Messen, Issue* 155 (*Ref. V*1343–5) T65–6 (*June*, 1948) *In German.*—A review, with bibliography, of the mechanisms of different types of Bourdon gauge made by American and continental firms. H. J. H. S.

531.788

74. A highly sensitive differential manometer. MATHESON, H., AND EDEN, M. *Rev. Sci. Instrum.*, **19**, 502–6 (*Aug.*, 1948).—Construction and performance of a differential manometer with a sensitivity of 0·001 mm of Hg over the range of absolute pressures from 1 mm of Hg to 1 atmosphere. The sensitive element employed is a pair of nesting diaphragms, displacement of which is measured by the resistive unbalance of an unbonded electrical displacement gauge to which the diaphragms are attached. Calibrations are presented for the sensitivity at 1- and 10-mA gauge current. Data are presented which indicate the operating characteristics under varying conditions of absolute pressure, temperature, gauge current, and geometric orientation. A.

531.788.6

75. An investigation on hot-wire gauges. III. VON UBISCH, H. *Ark. Mat. Astr. Fys.*, **36 A** (*Paper* 4) 14 *pp.* (1948) *In English.*—[See Abstr. 2041 (1947), 3123 (1948)]. The behaviour of the manually operated balanced bridge circuit is briefly discussed. By replacing the galvanometer by an amplifier, for which a detailed circuit diagram is given, automatic regulation of current is provided and the inconvenience of manual operation and the danger of overloading avoided. Attention is directed to the upper pressure limit of hot-wire gauges, and the calibration curves of a pyrex gauge with spiralled tungsten filaments for air, A, H_2 and CO_2 are given. The range in air is from about 10^{-3} to 50 mm Hg. The calibration curves of the several gauges described in I, II and III for the different gases are compared, and a conversion factor introduced which allows approximate calibrations for other gases to be calculated from the calibration for air. A survey of the numerical values of conversion factors is made. S. W.

531.788.7

76. An ionization manometer of high sensitivity. MAKINSON, R. E. B., AND TREACY, P. B. *J. Sci. Instrum. Phys. Ind.*, **25**, 298–9 (*Sept.*, 1948).—An ionization manometer is described in which the trajectories of the thermionic electrons are lengthened by means of a magnetic field. The ion-collecting electrode is a cylinder, the anode a wire along its axis and the filament is near the collector parallel to the axis; an axial magnetic field is applied. A sensitivity of 380 μA per micron was obtained at pressures below 0·8 μ. A.

531.788.7.089.6

77. The calibration and the sensitivity of ionization gauges. DAYTON, B. B. *Vide*, **2**, 349–55 (*Nov.*, 1947) *In French.*—Sensitivities of ionization gauges made by various American manufacturers are compared. The sensitivity is defined as the approx. value in μA of the current arriving on the collector pla with an electronic current of 5 mA, the collectors f electrons and ions being kept at 150 V and −25 respectively. Various McLeod gauges with a without polished capillary used for the calibration a described. The getter effect on the filaments ionization gauges is discussed. The results obtain by Blears [Abstr. 776 (1947)] are verified a various temperature effects are investigated. Mea are described for reducing grid-filament losses due metallic films formed on the inside of the bul Statements on the limiting fine-pressure and the spe of diffusion pumps using silicone oils as working flu must be treated with caution as a thin silicone fil deposited on the collector plate may falsify measur ments. Formulae for determining the gauge characte istic are discussed. R.

MECHANICS OF FLUIDS 532

532.13

78. Viscosity under rapidly-varying pressure. CHA RON, F. *C.R. Acad. Sci., Paris*, **225**, 919–21 (*Nov.* 1 1947) *In French.*—Determinations of the ballist viscosities of lubricating oils by the method describe in a previous paper [*C.R. Acad. Sci., Paris*, **224**, 1472– (1947)] lead to the conclusion that instantaneou values of the viscosity, η, under shock-pressure, is given by $\eta = \eta_H \varepsilon^{\alpha(p/h-1)}$, α being a consta for any given lubricant. In the case of glycerine 14·5°C, α has the value 0·0006145, while for aviatio oil "Shell CY_2," $\alpha = 0{\cdot}00306$. It is possible that th viscosity does not attain instantaneously the valu corresponding to the statically-impressed pressur This kind of hysteresis effect is particularly marked i the case of "Shell CY_2," but not so marked in th case of glycerine whose viscosity does not vary s appreciably with pressure. J. S. G.

532.133 : 532.

79. An interpretation of the viscosity of liquids BOSWORTH, R. C. L. *Trans. Faraday Soc.*, **44**, 308–1 (*May*, 1948).—An expression is derived for th viscosity of a liquid on the assumption that th carriers of momentum are "phonons" or particle equivalent to the mechanical waves into which th Einstein and the Debye theories of the specific hea resolve the molecular motion. It is further assume that λ_t is a measure of the mean distance from an arbitrary point in the liquid to a discontinuity o "hole" in the lattice as defined by the near neighbour of the arbitrary point. The expression for viscosit thus derived reads $\eta = 1{\cdot}75 \times 10^{-7} \frac{M^{5/6}}{T^{1/2}\rho^{1/3}\beta_s}$ wher M is the molecular weight, ρ the density and β_s th adiabatic compressibility. Good agreement wit experimental data is recorded for normal liquids bu for associated liquids the eqn. underestimates th viscosity and for mercury it overestimates the viscosity By using the relation between free volume and th velocity of sound as given by Kincaid and Eyring thi equation may be transposed to one giving viscosity i terms of molecular weight and free volume, similar to but not identical with, the empirical expression o Macleod. A

532.133 : 537.29 : 541.182

80. The electroviscous effect with measurements on sodium polymethacrylate solutions. ATEN, A. H. W., JR. Letter in *J. Chem. Phys.*, **16**, 636 (*June*, 1948).—Data from aqueous solutions of polymethacrylic acid and its sodium salt fit in with the following considerations: (1) Addition of electrolytes to a solution of a (negative) linear polymer, causes a rapid decrease of the viscosity in the concentration range where the "radius" of the ion sphere is of the same order of magnitude as the distance between the nearest charges on the chain which can move fairly independently. (2) The efficiency of different salts in lowering the viscosity increases rapidly with the charge of the positive ions. The charge of the negative ions is without influence. (3) Even at high electrolyte concentrations, the viscosity of the negative colloid is higher than that of the same polymer in the uncharged condition. H. H. HO.

532.51 : 550.491.55

81. Convection of a fluid in a porous medium. LARWOOD, E. R. *Proc. Camb. Phil. Soc.*, **44** (*Pt* 4) 508–21 (1948).—Under certain conditions convective flow may occur in fluid which permeates a porous stratum and is subject to a vertical temperature gradient, assuming that the flow obeys Darcy's law. The criterion for marginal stability is obtained for three sets of boundary conditions, and the motion described. If such convection occurs in a stratum through which a bore-hole passes, the usual method of calculation of the heat flow must be modified, but in general the correction will not be large. A.

532.511 : 530.145.1

82. Note on quantum hydrodynamics. GUROV, K. P. *J. Exp. Theor. Phys.*, **18**, 110–25 (*Feb.*, 1948) *In Russian.*—Deals with the derivation of the usual macroscopic eqs. of hydrodynamics for a "normal" fluid, from quantum mechanical equations of a molecular system. Stress is laid on the justification of this derivation and on the analysis of the physical premises underlying the method which appears as a quantum-mechanical analogue of Bogoljubov's method in classical physics. The assessment of the final results reveals that the quantum-mechanical basis is reflected in formulae for the determination of the coefficients of the hydrodynamical equations. A.

532.517.2 : 532.526

83. On laminar boundary-layer flow near a position of separation. GOLDSTEIN, S. *Quart. J. Mech. Appl. Math.*, **1**, 43–69 (*March*, 1948).—A study is made of singularities in the solution of the boundary-layer equations at a position of separation. Singularities may arise in non-linear parabolic equations. Formulae which may help computers of laminar boundary layers are given. A.

532.517.4

84. Experimental evidence for the theory of local isotropy. TOWNSEND, A. A. *Proc. Camb. Phil. Soc.*, **44** (*Pt* 4) 560–5 (1948).—New measurements of isotropic turbulence produced behind a biplane grid were made at high Reynolds numbers, and the results were compared with the predictions of the theory of local isotropy developed by Kolmogoroff. The transverse double-velocity correlation was measured at mesh Reynolds numbers up to $3{\cdot}2\times10^5$, and the observed form agrees well with the predicted form. Measurements of the skewness factor of velocity differences over finite intervals were also made, and the factor is nearly constant and equal to $-0{\cdot}38$, if the interval is small compared with the integral scale. The invariance of dimensionless functions of the velocity derivatives has been confirmed for the flattening factor of $\partial u/\partial x$, which is nearly constant over a wide range of conditions. It is concluded that the theory of local isotropy is substantially correct for isotropic turbulence of high Reynolds number. A.

532.526 : 532.517.2

85. The laminar boundary layer in compressible flow. COPE, W. F., AND HARTREE, D. R. *Philos. Trans.*, **241**, 1–69 (*June* 23, 1948).—The boundary-layer equations are derived, reduced to non-dimensional form, and their relation to the corresponding equations for an incompressible fluid is discussed. Methods of integrating them are considered, and it is shown that, provided there is no pressure gradient in the main stream, the methods employed for incompressible flow are of practical value. If there is a pressure gradient, the complications introduced by compressibility are such that numerical integration must be used at an early stage. This means that approximate methods of calculating separation lose their simplicity, and there are indications that their accuracy will also suffer. Direct integration of the equations is considered. Suitable expansions in one independent variable with coefficients which are functions of the other are obtained. The independent variables can be so chosen that the differential equations for the coefficients in the expansions have the same general structure as for an incompressible fluid. The boundary conditions and the limiting forms of the equations for zero Mach number are investigated. The application of iterative methods to the equations is discussed. The ENIAC and the methods of applying it to obtain solutions of the equations are described. Results for zero pressure gradient are obtained. A.

532.526 : 532.582.2

86. Note on the velocity and temperature distributions attained with suction on a flat plate of infinite extent in compressible flow. YOUNG, A. D. *Quart. J. Mech. Appl. Math.*, **1**, 70–5 (*March*, 1948).—The usual assumptions of boundary layer theory are made and these permit an exact solution of the equations of motion for compressible flow. The method for determining the distributions depends mainly on establishing a correspondence between the velocity and temperature profiles for compressible and incompressible flow, the former ordinates being scaled by factors which are functions of the ordinates and the Mach number, M. Results for $0 \leqslant M \leqslant 5$ are given. L. S. G.

532.57 : 621.317.39

87. An electromagnetic indicating or recording remote-reading rotameter. CLARK, W. J. *J. Sci. Instrum. Phys. Ind.*, **25**, 257–62 (*Aug.*, 1948).—Details of an all-metal type rotameter, developed with the object of removing certain serious limitations inherent in flow measurement by direct-reading indicating rotameters, are given. A simple method of recording which involves negligible reactive force on the float

and which is based on the electromagnetic circuit is used. The new meter combines many of the advantages of the indicating type, and readings can be transmitted to any reasonable distance. Applications include measurement of very small flows at any pressure, pulsating flows of liquors and possibly high-pressure gas, flows of corrosive fluids, flows where the metering element is exposed to frosty conditions, and flows where the use of indicating manometric liquids is undesirable. A.

532.570.82

88. A flowmeter for measuring small liquid flows. DENNIS, W. L. *J. Sci. Instrum. Phys. Ind.*, **25**, 317–18 (*Sept.*, 1948).—An apparatus is described which will deliver and measure small rates of flow of liquid. The apparatus is constructed entirely of glass and can thus be used for corrosive or non-corrosive liquids. When once calibrated it may be used for any liquid whose viscosity and density are known. A.

532.59

89. On the reflexion of surface waves by a submerged circular cylinder. DEAN, W. R. *Proc. Camb. Phil. Soc.*, **44** (*Pt* 4) 483–91 (1948).—An addition to earlier work [Abstr. 706 (1946)]. The coefficient of reflection is zero, so the only effect of an obstacle at a great distance is that there is a phase-difference between the incident and transmitted waves, the amplitudes being the same. L. S. G.

532.59

90. Waves in deep water due to a concentrated surface pressure. GREEN, G. *Phil. Mag.*, **39**, 738–43 (*Sept.*, 1948).—A method due to Lord Kelvin is used to solve the two problems of determining the wave-systems due to (1) a periodic surface pressure, and (2) a concentrated pressure moving at a uniform speed along the surface of the water. The solutions are compared with those obtained by Lamb and possible reasons for the discrepancies are given. Lamb's use of a fictitious frictional force leads to errors in the result. L. S. G.

532.595 : 532.526

91. Application of the theory of the boundary layer to the problem of the oscillations of a viscous heavy fluid in a U-tube. DE KÁRMÁN, T., AND VALENSI, J. *C.R. Acad. Sci., Paris*, **227**, 105–6 (*July* 12, 1948) *In French.*—It is shown, mathematically, that the postulation of a laminary boundary layer explains satisfactorily the greater part of the friction experienced during the oscillation of a feebly viscous fluid in a U-tube, provided the amplitude of the oscillations is very small. [*C.R. Acad. Sci., Paris*, **224**, 893 (1947)]. J. S. G. T.

CAPILLARITY 532.6

532.612.4 : 536.423.15 : 536.763

Internal pressure, vapour pressure and surface tension. *See Abstr.* 220

532.613.4 : 536.423.15

92. On the cause of the non-coalescence of liquid drops upon contact. DERJAGUIN, B., AND PROKHOROV, P. *C.R. Acad. Sci. URSS*, **54** (*No.* 6) 507–10 (1946) *In English.*—When liquid drops fall on the surface of the same liquid they may float for several minutes before coalescing with the liquid; also if two drops collide they may rebound. These are the phenomena investigated. Measurements were made of the thickness and profile of the gap between two drops forced out from 2 capillary tubes (end to end) before "contact" takes place. The drops may not merge for an indefinite time, so the profile may be measured. But in an atmosphere saturated with the vapour of the liquid it is impossible to prevent the drops from coalescing. The gap thickness was measured by microphotography of interference bands with vertical illumination by monochromatic light. L. S. G.

532.6[illegible]

93. On the behaviour of drops of liquid on the surface of a solid. I. Sliding of drops on an inclined plane. FRENKEL, Y. I. *J. Exp. Theor. Phys.*, **18**, 658–67 (*July*, 1948) *In Russian.*—The problem investigated is the change of the edge angle with the angle of inclination of a solid surface on which the drop rests, and the limiting angle of repose of the drop, thus the angle at which sliding starts. Sliding of the drop is initiated by overflowing of the liquid of which the drop consists in a downward direction, and a simultaneous tearing off of the rear edge from the supporting solid face. In the case of good wetting of the surface the drop leaves behind a short-lived moist trace which soon disintegrates into droplets. A.

532.692 : 541.68

94. Spreading of oils on metals. DUBRISAY, R., AND ARLET, F. *C.R. Acad. Sci., Paris*, **227**, 531–3 (*Sept.* 6, 1948) *In French.*—The spreading of paraffin oil on polished Cu is facilitated by the addition of a little oleic acid. Stearic and palmitic acids do not produce this effect, the explanation being that in the former case cupric oleate is formed, which dissolves in the oil and reduces its surface tension. The stearate and palmitate are not so readily soluble. This is confirmed by the observation that oleic acid has no effect in the absence of oxygen or humidity, in which case the Cu is not attacked. A similar effect has been observed with lead, but not with Ni, which is not attacked by oleic acid. M. R. H.

KINETIC THEORY OF LIQUIDS 532.7

532.7 : 534.25

Acoustic double refraction and relaxation time of liquids. *See Abstr.* 134

532.72

95. Theoretical and experimental study of a problem of cylindrical diffusion. COTTE, M., AND SALVINIEN, J. *C.R. Acad. Sci., Paris*, 223, 315–17 (*Aug.* 12, 1946) *In French.*—A spherical drop of liquid is deposited on a thin layer of gelatinous material covering a photographic plate. The liquid penetrates the material and diffuses outwards to form a circle of radius r at time t. The diffusion equation is solved in terms of Bessel functions, and the explicit formula giving r as a function of t appears as a definite integral. L. S. G.

MECHANICS OF GASES 533

533.15

96. The influence of a horizontal wall on the motion of a falling oil drop. HOPPER, V. D., AND GRANT, A. M. *Aust. J. Sci. Res. A* **1**, 28–40 (*March*, 1948).—A study has been made of the effect of a horizontal wall on the motion of oil drops of radii ranging from 5 μ to 15 μ falling in air. Provided that z/a, the ratio of the distance z of the oil drop from the wall to its radius a, is greater than 20, the resistance W to its motion is satisfied by the formula given by Lorentz, namely: $W = 6\pi\eta av(1 + \frac{9}{8}a/z)$. For z/a ranging from 2 to 500, the coefficient of a/z may be expressed empirically in the form $f(z/a) = k_1 + k_2 a/z$ where $k_1 = 1{\cdot}08 \pm 0{\cdot}05$ and $k_2 = 1{\cdot}4 \pm 1{\cdot}0$. A.

533.17.08

97. A field instrument for measuring volume and instantaneous flow rate of inspired air. SILVERMAN, L., PLOTKIN, T., AND LEE, G. *Rev. Sci. Instrum.*, **19**, 513–26 (*Aug.*, 1948).—A portable self-contained instrument which records the rates of inspiratory air flow through protective canisters under actual field conditions. Observations made in the laboratory can be checked under actual field conditions. Measurements of air flow on subjects in tanks or parachute troops or men moving in industrial operations cannot be obtained without a portable instrument. The essential requirements of this instrument are that it obtain records of air flow, air volume, and respiration rate while worn by or held closely to the individual under observation. The apparatus should be rugged and independent of positional effects or a reasonable amount of rough handling. Its operation should be automatic and not require attention by the subject. A.

533.24

98. An improved type of helium liquefier and cryostat. DAUNT, J. G., AND MENDELSSOHN, K. *J. Sci. Instrum. Phys. Ind.*, **25**, 318–20 (*Sept.*, 1948).—A small helium liquefier and cryostat, working with Joule–Thomson expansion, is described. A novel feature of the apparatus is the controllable expansion valve which is thermally separated from the helium collected in the cryostat. This allows the actual liquefaction to be carried out comparatively rapidly, permitting in the same apparatus experiments with liquid helium to be carried out for many hours. To permit visual observation the helium cryostat is made of glass and attached to the metal construction of the apparatus by Housekeeper seals. A.

533.275.08

99. Psychrometric moisture determination in gases. BRAUCKHOFF, H. *Arch. tech. Messen, Issue No.* 152 (*Ref. V*1283–7) *T*17 (*Oct.*, 1947) *In German.*—Discusses the use of the wet and dry bulb thermometer in gases other than air and tabulates the psychrometer constant A in the equation connecting the vapour pressure and wet bulb depression ($p = p_{sat} - A\Delta t$) for several mono-, di- and triatomic gases. C. F. B.

533.5

100. Vacuum systems, seals, and valves. KURIE, F. N. D. *Rev. Sci. Instrum.*, **19**, 485–93 (*Aug.*, 1948).—This paper is concerned with certain aspects of the technique of all-metal, kinetic vacuum systems which have proved their reliability. A brief account is given of the constitution of a system to operate down to pressures of the order of 10^{-5} mm. Precautions to be observed in assembling such a system and in its general care and maintenance are discussed. In all systems reliable, high speed valves are needed. Some which are quite satisfactory for many uses are available. In the event that it is necessary to construct such a valve, a modification of a standard brass gate valve is described. The problem of rubber gaskets is discussed in some detail, and suggestions are made which may relieve some of the difficulties which are occasionally encountered with them. The attention of experimenters is called to the usefulness of O-rings and a number of examples of their use is given. A.

533.51

101. The glycerol vapour vacuum pump. ALEXANDER, P. *J. Sci. Instrum. Phys. Ind.*, **25**, 313–14 (*Sept.*, 1948).—The efficiency of a vapour pump in the various pressure ranges is determined mainly by the vapour pressure of the pump liquid as a function of the temperature. Glycerol at normal temperature has a lower vapour pressure than mercury, and at higher temperatures a higher vapour pressure than most of the pump oils. The efficient working range of the glycerol vapour pump is, therefore, wider than that of the oil vapour pumps, and they work more efficiently than the mercury vapour pumps in the lowest pressure ranges. Glycerol pumps have been tested in continuous use over a long period of time. A.

533.6.011 : 534.222.2

102. The influence of gravity upon the expansion of a gas. I–II. BURGERS, J. M. *Proc. K. Ned. Akad. Wet.*, **51** (*No.* 2) 145–54; (*No.* 5) 525–32 (1948) *In English.*—The effect of gravity upon the expansion of a perfect gas is discussed under the condition that motion of the gas is restricted to the vertical direction. In the case in which $c_p/c_v = 5/3$, the derived equations can be integrated by Riemann's method, the auxiliary Riemann function being expressed in finite terms. The motion of the element of volume is expressed in terms of rational functions of the velocity of the element and the velocity of sound in the element. Irregularities in certain parts of the column suggest the occurrence of shock waves. Approximate formulae are given for the co-ordinates and parameters characterizing the motion of an elementary volume of gas expanding under gravity. The formulae show how the shock wave originates, and permit the determination of a first approximation to the position of the wave in the field of motion. J. S. G. T.

533.6.011 : 536.711

103. On the energy equation in the rectilinear motion of a gas. VILLE, J. *C.R. Acad. Sci., Paris*, **223**, 308–10 (*Aug.* 12, 1946) *In French.*—The equations of motion are used to derive the energy equation, which contains a term due to the work of the internal forces. Application is made to a discontinuity in the motion of the gas, and to an adiabatic expansion. L. S. G.

533.6.011.1 : 536.23 : 536.7

The thermodynamics of gas flow. *See Abstr.* 218

533.6.011.1/312 : 533.77

104. Air resistance as the integral of the entropy stream. OSWATITSCH, K. *Nachr. Wiss. Göttingen* (*No.* 1) 53–5 (1945) *In German.*

533.6.011.3

105. Axially symmetric gas flows in cavities of revolution of small width. SPANNHAKE, W. *Z. angew. Math. Mech.*, **25/27**, 154–5 (*Aug.–Sept.*, 1948) *In German.*

533.6.011.3

106. Passage of a non-stationary gas flow determined theoretically and experimentally. SCHULTZ-GRUNOW, F. *Z. angew. Math. Mech.*, **25/27**, 155–6 (*Aug.–Sept.*, 1948) *In German.*

533.6.011.4/.5 : 534.222.2

107. On the formation of shock-waves in supersonic gas jets. PACK, D. C. *Quart. J. Mech. Appl. Math.*, **1**, 1–17 (*March*, 1948).—The jet issues from an orifice as a parallel stream and flows in a steady state through an outer medium at rest. The state is discussed from the point of view of the characteristics of the hyperbolic 2nd-order equation of potential flow. The periodic structure of the jet is only a first approx. and is inadequate as the pressure ratio (exit pressure/pressure of outer medium) is increased. Shock waves occur because of the compressive effect of the outer medium, and it is shown how the point of origin of the shock-wave and the shape of the shock-wave may be obtained theoretically. A comparison with experimental work, in 2 cases, is carried out. The minimum pressure in the jet is calculated. A.

533.6.011.5 : 532.582.6

108. Supersonic flow past slender pointed bodies of revolution at yaw. LIGHTHILL, M. J. *Quart. J. Mech. Appl. Math.*, **1**, 76–89 (*March*, 1948).—The exact equations of isentropic motion are used to derive an approx. expression for the pressure coefficient, and this is accurate enough to give the lift and moment coefficients and the drag coefficients. A.

533.6.011.5 : 532.582.6

109. Supersonic flow past slender bodies of revolution the slope of whose meridian section is discontinuous. LIGHTHILL, M. J. *Quart. J. Mech. Appl. Math.*, **1**, 90–102 (*March*, 1948).—Expressions for the pressure distribution on the surface are obtained. The drag coefficient is not independent of the Mach number and tends to zero more slowly than the square of the thickness of the body. The large pressure change behind a discontinuity is made up very rapidly. A.

533.6.011.5

110. The efficiency of compression by stationary shock-waves in a supersonic gas-stream. CHAIX, B. *Schweiz. Arch. angew. Wiss. Tech.*, **14**, 39–49 (*Feb.*); 161–9 (*June*, 1948) *In French.*—The increase in pressure of a supersonic gas-stream as it passes through oblique shock-waves in a supersonic diffuser, a normal shock-wave and a subsonic diffuser is examined theoretically. Graphs are given showing the efficiency of pressure-recovery in the above processes (separately and in optimum combination). Loss of efficiency may arise from (*a*) shock-waves in the main stream, (*b*) kinetic energy of the stream after the final shock and (*c*) friction and shock-waves within the boundary layer. Losses due to (*a*) and (*b*) are estimated from classical shock-wave theory; th due to (*a*) are generally of little importance. Los due to (*c*) are evaluated on the assumption that boundary layer does not affect the main stream fl it is necessary to introduce several experimenta determined coefficients which restrict the applicabi of the results. It is claimed that shock-wave cc pression gives an overall adiabatic efficiency of 8 for compression ratios between 2 and 20. This meth of compression is particularly useful when compa ness is desired and when the operating conditions variable. A. S.

533.6.01

111. On thermal critical state in a gas fl ABRAMOVICH, G. N. *C.R. Acad. Sci. URSS*, (*No.* 7) 575–7 (1946) *In English.*—Gas flows ir cylindrical tube, to a part of which heat is suppli The gas density is diminished by heating, the velo increases and the pressure falls. By supplying suitable amount of heat the velocity may be raised a critical point, such that further increase in inflow velocity of the cold gas is impossible. Eq tions describing the heat flow are given. Th determine the ratio of the velocity after heating to initial velocity, and the drop in pressure. L. S.

533.6.013

112. The laws of resistance and thermal tension i turbulent frontal layer. FEINSILBER, A. M. *C Acad. Sci. URSS*, **54** (*No.* 8) 669–72 (1946) *French.*—The formula for the velocity distribution the layer is used to calculate the law of resistance the layer (the result agrees with that of Kármá and the energy equation leads to an integral form for the thermal tension. L. S.

533.6.05 : 53.082.3 : 53.08

113. The physical principles of some basic aircr instruments. HOATHER, W. H. *J. Sci. Instrum. Ph Ind.*, **25**, 113–22 (*April*, 1948).—The conditions measurement of various quantities are given in det with descriptions of instruments. These inclu (*a*) Height; using barometric principles with int national standards connecting height with temp. a press. (*b*) Airspeed; a pitot-static tube is the bas with an altimeter diaphragm and a temp. element a correction for true airspeed. For speeds near so the Mach number is of importance and max. s airspeed instruments are described. (*c*) Rate of clim a static pressure instrument depending on rate change of local pressure. (*d*) Engine speed; electri methods are now usual, the latest being 3-phase w no brushes. A synchroscope is now common multi-engined machines, relating speeds to o engine. (*e*) Magnetic compass; remote indication being developed with the compass, sometimes with gyro stabilizer, in a location away from magne fields. E. H. W.

533.691

114. Gliding of a wing in a viscous fluid. STR MINSKY, V. V. *C.R. Acad. Sci. URSS*, **54** (*No.* 571–4 (1946) *In French.*—The wing is rectangular a of infinite length. The Navier–Stokes equations a written down and solved, and the components of t resulting force are determined. The equations of t wave-profile, for large Reynolds numbers, are solve L. S.

KINETIC THEORY OF GASES 533.7

533.7 : 534.222.2

The kinetic theory of the shock wave. *See Abstr.* 126

533.7 : 536.48 : 531.19

115. Kinetic equations in the theory of super-fluidity. BOGOLIUBOV, N. N. *J. Exp. Theor. Phys.*, **18**, 622–30 (*July*, 1948) *In Russian.*—Deals with the interaction between the elementary excitations of a slightly non-ideal Bose–Einstein gas considering 3rd-order terms in the Hamiltonian system. By means of the usual calculation of transition probabilities the kinetic equation for elementary excitations is obtained. Its equilibrium solutions are discussed, and the corresponding *H*-theorem is found. A.

533.73 : 533.15

116. A note on gaseous thermal diffusion: the effect of a third component. CHIPMAN, J., AND DASTUR M. N. Letter in *J. Chem. Phys.*, **16**, 636–7 (*June*, 1948).—Experiments have verified the prediction of an elementary theory of thermal diffusion that this effect for two gases, varies inversely as the mean square-root mass of all constituents of the mixture used, and is therefore increased by the addition of a third gas of low molecular weight. The numerical factors in the complete expression for the thermal diffusion were not verified. The thermal diffusion is that between O_2 and water vapour, with He or A as the diluting gas. In one set of measurements Hg was added. The measurements were made in the study of the reaction of H_2 with O_2 dissolved in molten Fe. Two temperature ranges were measured, with the iron at 1 563° G. J. K.

VIBRATIONS . ACOUSTICS 534

534.01 : 517.947.2/.3

117. Integral and series representations for the different types of waves of mathematical physics in axial-parabolic coordinates. BUCHHOLZ, H. *Z. Phys.*, **124** (*Nos* 3–6) 196–218 (1948) *In German.*—Representations of the required form are found for standing waves and outgoing waves of any harmonic type when the source is at the focus of the parabola. Plane waves and cylindrical waves are included also as special cases. Representations are also obtained for an arbitrary position of the source. G. J. K.

534.11

118. The lumping of distributed mass. HUDSON, G. E., AND SPECHT, R. D. *J. Acoust. Soc. Amer.*, **20**, 648–51 (*Sept.*, 1948).—The natural frequencies of longitudinal vibration of a rod fixed at one end and carrying a concentrated mass at the other end can be found by solving the transcendental frequency equation. Rayleigh showed that a good approximation to the fundamental frequency is got by replacing the distributed system by a simple harmonic oscillator having one degree of freedom, whose stiffness equals the original stiffness of the rod and whose mass equals the end-mass increased by $\frac{1}{3}$ the mass of the rod alone. The factor $\frac{1}{3}$ may be replaced by some other "lumping coefficient" λ. It is shown that Rayleigh's lumping coefficient $\lambda = \frac{1}{3}$ is the best possible one when the end mass is large compared with the mass of the rod alone, and leads to a maximum error in the frequency of 10·3%. This maximum error takes a minimum value of 1·68% when a lumping coefficient $\lambda_0 = 0{\cdot}3919974$ is used; this "best" coefficient yields a better approximation to the fundamental frequency than does the Rayleigh coefficient when the end mass is less than 0·511 times the mass of the rod alone. The variable lumping coefficient, which is a function of the masses involved, is discussed. A.

534.111 : 531.53

119. On sub-harmonic synchronization. HAAG, J. *C.R. Acad. Sci., Paris*, **223**, 525–7 (*Oct.* 7, 1946) *In French.*—Extension of previous work [Abstr. 2525 (1946)]. The theory is based on the study of the properties of a pair of simultaneous differential equations, and conditions for a stable solution are given. Application is made to a type of pendulum whose motion is maintained electrically [Abstr. 145 (1939)]. L. S. G.

534.133 : 534.232

120. Reciprocal properties of elastic waves in anisotropic media. POST, E. J. *Proc. K. Ned. Akad. Wet.*, **51** (*No.* 1) 65–72 (1948) *In English.*—Directions in an elastic medium, such that if one is the direction of propagation of an elastic wave the other is the direction of the corresponding displacement vector, and vice versa, are defined as reciprocal. The conditions of reciprocity are investigated in the notations of tensor analysis and also their bearing on other elastic wave phenomena. The theory is supported by experimental results relating to the piezo-electric resonator. G. G.

534.15

121. Reciprocity calibration of primary vibration standards. THOMPSON, S. P. *J. Acoust. Soc. Amer.*, **20**, 637–40 (*Sept.*, 1948).—The reciprocity method for the absolute calibration of vibration transducers is reviewed, and the design and calibration of a set of primary standard transducers is described. Resulting calibrations are shown to be both reliable and accurate up to at least 700 c/s. A.

534.213.4 : 534.24

122. On the reflection of a sound wave at the open end of a tube. WEINSTEIN, L. A. *Dokl. Akad. Nauk SSSR*, **58** (*No.* 9) 1957–60 (1947) *In Russian.*—In previous investigations the mathematical analysis was simplified by assuming that the open end of the tube is fitted with an infinite plane flange; the present paper deals with an unflanged tube. The problem is reduced to an integral equation of the Wiener–Hopf type, which is solved numerically. It is found that the open-end-correction for a pipe is $0{\cdot}613a$ (where a is the radius of the pipe). This agrees more closely with the experimental value $0{\cdot}60a$ than do the theoretical values for flanged tubes ($0{\cdot}785a$ to $0{\cdot}82a$). A. SCH.

534.213.4 : 534.414

123. On the radiation of sound into a circular tube, with an application to resonators. INGÅRD, U. *J. Acoust. Soc. Amer.*, **20**, 665–82 (*Sept.*, 1948).—The radiation from a plane piston into a rigid circular tube is treated. Consideration is given to the propaga-

tion of higher order sound waves. Curves of radiation impedance and pressure distribution are given together with an analysis of the elements of the equivalent impedance circuits. In addition to the closer study for special values of the tube's end impedance, some outline of the general case is given. Simplified measurements verify the calculations in the case of a tube closed by a rigid wall. Finally, the resonance frequency of cylindrical resonators is discussed. A.

534.22 : 534.833

124. Relation between sound velocity and absorption with acoustic relaxation. KNESER, H. O. *Ann. Phys., Lpz.* (*Folge* 5) **43** (*Nos* 6–7) 465–9 (1943) *In German.*—Formulae for the variation of sound velocity and absorption with frequency are derived by 2 independent methods. For a given temperature, experimental values may be plotted on a simple geometric semi-circle diagram. The relaxation time, and the phase angle between pressure and contraction, can be read off directly from this diagram. Results of absorption and velocity measurements with oxygen of varying purity, and carried out by different observers, closely agree with the predicted semi-circle diagram, and corroborate the theory. V. W. R.

534.222.1 : 534.321.9 : 551.463

125. Marine reverberation taking account of sound absorption. SUKHAREVSKY, J. M. *Dokl. Akad. Nauk SSSR*, **58** (*No.* 2) 229–32 (1947) *In Russian.*—It is shown that for frequencies >10 kc/s sound-absorption due to solid spheres <1 mm radius or air-bubbles <0·1 mm radius is ≫ sound-dispersion. Dispersion is appreciable for air-bubbles several mm in dia.; these are concentrated near the surface. The sea is therefore treated as a medium having the following characteristics: absorption and dispersion are small, except in an upper layer, where absorption decreases with depth; throughout this layer dispersion remains small except very near the surface, where it increases rapidly and becomes of the same order as absorption. The propagation of ultrasonic waves in such a medium is investigated theoretically. A. SCH.

534.222.2 : 533.7

126. The kinetic theory of the shock wave. HERPIN, A. *Rev. Sci., Paris*, **86**, 35–7 (*Jan.* 1, 1948) *In French.*—In a former paper [*Rev. Sci., Paris*, **85**, 817–26 (1947)] the author had shown that an extension of the kinetic theory is required for explaining the process of transformation of kinetic energy into heat energy taking place within a shock wave. The present paper constitutes a first attempt in this direction. The theory given leads to Hugoniot's law of compressibility and allows an estimate of the thickness of the transition zone to be made. G. G.

534.23

127. The sonic field of a point source moving with uniform translation. HÖNL, H. *Ann. Phys., Lpz.* (*Folge* 5) **43** (*Nos* 6–7) 437–64 (1943) *In German.*—A rigorous treatment of the sonic field due to a point source moving through a stationary medium at subsonic and supersonic velocities. The 2- and 3-dimensional cases are solved by Fourier integrals. If the propagation of sound-waves is assumed independent of the motion of the source, the sonic field can be drawn by simple geometry using Huyghen's principle. The latter geometric method is shown yield approx. correct results, but discrepancies betw the rigorous and approximate method occ especially at supersonic speeds. V. W.

524.23

128. Acoustic impedance of small section tu BARDUCCI, I. *R.C. Acad. Naz. Lincei*, **2**, 43 (*April*, 1947); *Pubbl. Ist. Naz. Elettroacust. O Corbino* (*No.* 68) *In Italian.*—Formulae based on work of Helmholtz, Kirchhoff and Rayleigh are gi for the acoustic impedance of tubes of circular secti It is suggested, without any mathematical or exp mental proof, that they can be used for tubes non-circular section. T. S. E.

534.23

129. Determination of the characteristic paramet of an acoustic impedance. FERRERO, M. A., A SACERDOTE, G. G. *Nuovo Cim.*, **5**, 162–4 (*June*, 19 *In Italian.*—A new graphical method to obtain parameters of propagation in a homogene acoustical material is given: it is not necessary know the acoustical impedance for two lengths of material in a definite ratio, the method being based the consideration of small variations of the impeda for corresponding length variations of the mater The method is suitable when the propagation pa meters are not constant, but variable with the len of the material. An example of calculation fo material composed of metallic wires is given.

534.232 : 534.12

130. Radiation from a diaphragm struck periodica by a light mass. STRASBERG, M. *J. Acoust. S Amer.*, **20**, 683–90 (*Sept.*, 1948).—Expressions obtained for the energy radiated by a clamped circu diaphragm excited by periodic impacts. The radiati consists of a line spectrum with intensity maxima the neighbourhood of the resonant frequencies of various vibrational modes of the diaphragm. T energy in the spectrum lies almost entirely belo frequency equal to twice the reciprocal of the time contact of the hammer with the diaphragm at ea impact. Expressions for the efficiency of the syst as a convertor of mechanical energy into acousti energy are derived, and the conditions resulting maximum efficiency are determined. Curves presented to assist the calculation for the case o steel diaphragm in water.

534.232 : 534.21

131. The coupling of a cylindrical tube to a ha infinite space. MILES, J. W. *J. Acoust. Soc. Ame* **20**, 652–64 (*Sept.*, 1948).—The radiation admitta of a semi-infinite space, as seen by a cylindrical tu through an aperture in an infinite plane, is comput The pressure fields in the tube and half-space developed in terms of the axial velocity in the ap ture, and an integral equation for this velocity determined. It is shown that the velocity funct which satisfies this integral equation makes the r and imaginary parts of the radiation admitta absolute minima. An asymptotic expression for field at a distance from the aperture is developed, a reflection and transmission coefficients are det mined in terms of the radiation admittance. T general theory is applied to a circular tube and infinite slot. Numerical results are given in the fo

of curves, and the results for the circular tube are compared with those obtained by Rayleigh. A.

534.232 : 534.874

132. On the calculation of radiating bases. PARODI, M., AND PIRCHER, G. *C.R. Acad. Sci., Paris*, **226**, 872–4 (*March* 15, 1948) *In French.*—A Laplace transformation is used to determine bases of emission or reception having as sharp as possible a principal maximum, and negligible secondary maxima, in a given direction. The process employed determines a linear distribution having amplitudes equal to the amplitudes of a specified initial distribution raised to a given power. G. G.

534.24 : 534.12

133. Reflection of sound from submerged plates. FINNEY, W. J. *J. Acoust. Soc. Amer.*, **20**, 626–37 (*Sept.*, 1948).—It has been found that an appreciable reflection occurs in the direction of the incident wave when high frequency underwater sound strikes a submerged steel plate at an oblique angle of incidence. The magnitude of this "non-specular" reflection, together with the associated transverse vibrations in the plate, has been studied experimentally as a function of frequency, plate dimensions and angle of incidence. Significant non-specular reflection occurs from bounded plates between $\sim\frac{1}{4}$ in and 2 in thick, when the product of thickness in in. and frequency in kc/s lies between about 20 and 60. Within this range, the angle of incidence for maximum non-specular reflection, η is described by the empirical relation: $\sin\eta = 2{\cdot}16/(bf)^{\frac{1}{3}}$. This relation has been found to apply also to 0·002 in plates at 15 Mc/s. The results of the present study are in agreement with a theoretical analysis by Fay, and with the experimental results obtained by Sanders at frequencies of several Mc/s. A.

534.25 : 532.7

134. Acoustic double refraction and relaxation time of liquids. TSVETKOV, V. N., AND ESKIN, V. E. *J. Exp. Theor. Phys.*, **18**, 614–21 (*July*, 1948) *In Russian.*—The effect was studied on linseed oil and its dependence on the amplitude of ultrasonic waves of a given frequency, varied during the tests, determined. Then the acoustic double refraction of eight liquids was investigated in the range of frequencies 0·9–11·1 Mc/s. Four of the tested liquids exhibited a linear dependence of the effect on the frequency, the remaining 4 showed relaxation phenomena. The kinetic theory of acoustic double refraction enables the time of orientation relaxation for the molecules of castor oil and mineral vacuum oils to be calculated. The corresponding values are $1{\cdot}5\times10^{-7}$ and $4{\cdot}5\times10^{-8}$ sec resp. The magnitude of the double refraction observed is in good agreement with theory. A.

534.321.7 : 612.858.74

135. Chroma fixation at the ends of the musical frequency scale. BACHEM, A. *J. Opt. Soc. Amer.*, **20**, 704–5 (*Sept.*, 1948).—It is observed that tone chroma reaches a definite limit near the upper (and perhaps lower) end of the musical range, while tone height still increases (or decreases) perceptibly. A.

534.321.9 : 534.845

136. Absorption of supersonic waves in liquid of very high viscosity. MIKHAILOV, I. G., AND GUREVICH, S. B. *Dokl. Akad. Nauk SSSR*, **58** (*No.* 2) 221–4 (1947) *In Russian.*—The large discrepancy between forecasts according to the Stokes–Kirchhoff classical theory and the much higher absorption observed is explained by the influence of the not negligible spatial viscosity, which has a relaxation character and is dependent on frequency. Experimental investigations on rosin in the temperature range 40–145°C with viscosity changes of 1 to 10^8 times, at 1·5 and 3 Mc/s, are described, and show good agreement with Frenkel's theory. A. L.

534.321.9 : 537.312 : 541.133

On the influence of rapid changes of temperature and pressure on the resistance of electrolytes. *See Abstr.* 322

534.321.9 : 538.652 : 621.392.51

137. A 100 kc underwater magnetostrictive transducer. CAMP, L., VINCENT, R., AND DU BREUIL, F. *J. Acoust. Soc. Amer.*, **20**, 611–15 (*Sept.*, 1948).—A description of the design and construction of a 100 kc/s underwater magnetostrictive transducer having a beam width 20° wide 6 db down. Operating at remanence, it may be driven with 40 W at 50% efficiency. A.

534.321.9 : 538.652 : 621.392.51

138. Lamination designs for magnetostrictive underwater electroacoustic transducers. CAMP, L. *J. Acoust. Soc. Amer.*, **20**, 616–19 (*Sept.*, 1948).—A theory for the design of laminations to be used in the construction of transducers having a plane piston-like radiating face. Data show how well the theory predicts the operating characteristics of these transducers. A.

534.321.9 : 612.858.76

139. Biological and psychological effects of ultrasonics. DAVIS, H. *J. Acoust. Soc. Amer.*, **20**, 605–7 (*Sept.*, 1948).—Ultrasonic and also sonic waves of high intensity may produce discomfort and even injury. The dominant biological effects of various parts of the frequency spectrum are summarized. "Discomfort" implies that some sense organ is affected; but some combinations of intensity, frequency, and duration of exposure may possibly injure without the usual warning of discomfort. For the benefit of personnel working in high intensity sonic or ultrasonic fields, both discomfort and danger contours should be established, and there are wide gaps in present knowledge. The Ultrasonics Panel of the U.S. Aeronautical Board desires particularly to receive any relevant well-authenticated observations, either positive or negative, particularly concerning the effects of high-intensity sound or ultrasonics on the sense organs and the nervous system. Casual publication of isolated, uncontrolled but spectacular "observations" may cause widespread popular apprehension and hinder the adoption of methods and instruments that involve ultrasonics of any sort. A.

534.322.1 : 787.1

140. The timbre of old Italian master violins. ROHLOFF, E. *Z. Naturforsch.*, **3a**, 184–5 (*March*, 1948) *In German.*—The analysis and interpretation of 240 sound spectra of old Italian violins contrasted with those of a very good modern make shows that the intrinsic character of the spectrum is the same for

all the old instruments, particularly where the deep strings (g and d) are concerned, but only vaguely indicated in modern violins. This accounts for the well-known differences in sound which are thus due to a certain relative distribution of the sound pressure amplitude on fundamentals and harmonics.

534.793 : 534.611 : 534.323.083

141. Loudness measurement. GOSEWINKEL, M. *Arch. tech. Messen, Issue* 155 (*Ref. V*55–4) *T*70–1 (*June*, 1948) *In German.*—The Fletcher–Munson curves relating sound frequency, intensity and loudness are discussed. The definition of loudness in terms of the normal tone (1 000 c/s) intensity is given, and various systems of loudness measurement described (*a*) according to definition, (*b*) Barkhausen's method, and (*c*) the D.I.N. system, (*d*) other methods. A. B. W.

534.833 : 534.22.093 : 534.222.1

142. Absorption and dispersion of sound in gases with chemically reacting and excitable components. I. MEIXNER, J. *Ann. Phys., Lpz.* (*Folge* 5) **43** (*Nos* 6–7) 470–87 (1943) *In German.*—The absorption and dispersion of sound in ideal gases of any composition is mathematically investigated; the component gases may consist of chemically reacting or excited molecules. The irreversible processes of internal friction, heat conduction, diffusion, chemical reaction and excitation each contribute to the absorption and dispersion. The contributions are not simply additive, however, but are inter-related. The relation between sound absorption and local entropy and energy dissipation is investigated for the case of high frequency and low transformation velocity. V. W. R.

534.845 : 534.321.9

143. Ultrasonic absorption in water in the temperature range 0°–80°C. SMITH, M. C., AND BEYER, R. T. *J. Acoust. Soc. Amer.*, **20**, 608–10 (*Sept.*, 1948).—Absorption of ultrasonic waves in water has been measured at temperatures from 0°C to 80°C at six frequencies between 12·25 Mc/s and 40·50 Mc/s. The experimental values are shown to agree within experimental error with the theoretical values calculated by Hall [Abstr. 2400 (1948)] on the basis of a structural absorption. A.

534.88 : 534.22 : 621.395.615

144. Bearing deviation indicator for sonar. SCHUCK, O. H., STEDMAN, C. K., HATHAWAY, J. L., AND BUTZ, A. N., JR. *Trans. Amer. Inst. Elect. Engrs*, **66**, 1285–95 (1947).—Bearing determination with this equipment, described in Abstr. 2084 (1947), can be effected by dividing the transducer into two parts for receiving purposes and combining the echo signal from each half with a delayed echo signal from the other, thereby providing split beam reception for subsequent amplitude or phase comparison. Two such equipments are described in detail as well as auxiliary circuits for reverberation-controlled gain, own-doppler nullification and doppler-controlled gain. Test equipments and training aids are also discussed. H. G. M. S.

534.88–8 : 621.392.51 : 538.652

145. Blind guidance by ultrasonics. SLAYMAKER, F. H., AND MEEKER, W. F. *Electronics*, **21**, 76–80 (*May*, 1948).—The limitations due to different reflection characteristics of various surfaces and objects and to fluctuations in reflection, when a portable "radar" system is employed, are discusse Simple pulse, simple f.m. and pulsed-f.m. systems, embodying separate transmitting and receivi magnetostriction transducers, are compared. T latter, which employs an ultrasonic oscillator wi sawtooth variation of frequency but has narrow-ba transducers, is considered the best because it intr duces no contradictory information and permits sor distinction between objects at different points. O model, operating at 32 kc/s, with 10 valves, mainly the subminiature type, for transmitter and receiv and using headphones, enables the presence of person to be detected at 30 ft. Later equipment is al described. H. G. M.

OPTICS . RADIATION . SPECTRA 535

535.14 : 537.12 : 621.384

146. Semi-quantum calculation of the spectrum radiation by electrons in a circular accelerato ABRAGAM, A. *J. Phys. Radium* (*Sér.* 8) **9**, 143– (*April*, 1948) *In French.*—The radiation is calculate after quantizing the radiation field, in a simp manner. The results agree with those obtained b classical methods, and show that they are general valid. G. J.

535.214.6 : 538.6

147. Explanation of the phenomena of phot phoresis with reference to a note by M. Tauzi COTTON, A. *C.R. Acad. Sci., Paris*, **225**, 969–7 (*Nov.* 24, 1947) *In French.*—Various factors, whic might be involved in magneto-photophoresis, a considered. W. R.

535.22 : 530.12 : 531.1

148. The measurement of the velocity of light signals sent in one direction. IVES, H. E. *J. Op Soc. Amer.*, **38**, 879–84 (*Oct.*, 1948).—The proble of measuring the velocity of light by signals sent one direction, instead of the usual method, by signa sent out and back, is studied. This requires tw clocks, and the necessary steps to set the two cloc are discussed. It is found desirable to distinguis between "velocity" in its elementary and tradition sense, and the "rod-clock-quotient" directly obtaine by measurement with rods and clocks experiencin the Fitzgerald–Larmor–Lorentz contractions. Th precise formula derived for the one-way measureme of the velocity of light involves two rod-clock-quot ents. The use of one-way light signal measuremen in the Lorentz transformations and the special theo of relativity is discussed.

535.23.08 : 537.312.62 : 621.317.7

149. The infra-red sensitivity of superconducti bolometers. FUSON, N. *J. Opt. Soc. Amer.*, 3 845–53 (*Oct.*, 1948).—Niobium nitride superco ducting bolometers have been studied for sensitivi when irradiated with a wide band of modulated infr red radiation of $\sim 0{\cdot}1\ \mu W/mm^2$ intensity. T bolometer response was amplified by means of matching input transformer and wide-band amplifie Time constants for different bolometers ranging fro 0·7 to 17·0 msec were observed. Compariso are given between these superconducting bolomete

and other infrared detectors described in the literature. Of the 25 superconducting bolometers studied in detail the 9 most sensitive had figures of merit ranging from 14·0 to 1·3. A.

535.247 : 621.385.832 : 621.396.9

150. A recording photometer and its use in studies of cathode-ray screen displays. HAMBURGER, F., JR., AND KING, E. J. *J. Opt. Soc. Amer.*, **38**, 875–9 (*Oct.*, 1948).—In studies involving the performance of operators of radar indicators it became necessary to provide data concerning the transient light patterns generated on the screens of c.r. tubes. This paper describes a photometer which permits the determination of brightness at any instant at a selected point on the radar screen. A 931-A photo-multiplier tube combined with suitable optical and electronic auxiliaries provides a photometer that will respond faithfully to rapid light transients for peak brightness determinations, and will also provide data for slow brightness changes associated with phosphor decay characteristics. The photometer described is useful down to 0·005 footlamberts when examining a circular area 0·025 in. in diameter. It will measure much greater brightness levels by incorporated sensitivity controls. Its usefulness is not limited to radar screen measurements but it is applicable to many photometric problems. A.

535.247.1 : 778.3

151. Photographic photometry. FINK, L. *Arch. tech. Messen, Issue No.* 154 (*Ref. V*422–5) *T*49–50 (*April*, 1948) *In German.*—A brief review with a bibliography of 116 references.

535.247.4 : 531.714.2

152. The Fürth microphotometer and its application in physics. FÜRTH, R., AND OLIPHANT, W. D. *J. Sci. Instrum. Phys. Ind.*, **25**, 289–94 (*Sept.*, 1948).—The Fürth microphotometer, by the application of electronic principles, depicts instantly on the fluorescent screen of a cathode-ray oscillograph the densigram record. It provides for a rapid visual survey of the whole photographic plate under examination and of any particular part of the plate in fine detail. Magnifications along the line of traverse (or scan) of the order of 1 000 or more may be obtained, which are $\geqslant$ those for existing types, and no elaborate gearing mechanism is necessary. The use of photocells or electron multipliers whose maximum photoelectric sensitivity lies within the visible part of the spectrum, permits the use of ordinary incandescent filament projector lamps, and at the same time enables an optical system to be built up from readily obtainable lens systems. The instantaneous operation obviates the necessity for incorporating compensating photoelectric elements and for stringent constancy of the analysing light source. The resolving power is adequate for the majority of practical applications. A.

535.313

153. On the condenser with two spherical mirrors. BIOT, A. *Ann. Soc. Sci., Brux.* **62** (*Sér.* 1) 83–92 (*May* 25, 1948) *In French.*—The theory of the spherical mirror-cardioid condenser is given. It is then shown that a spherical mirror can be chosen such that any three rays from an aberrated object point are homocentric after reflection. A general theory of the two-spherical-mirror condenser shows that aplanatism is only attained with a concentric system. A formula is given for the ratio of the curvatures of the two mirrors in order to correct the spherical aberration for a given aperture. H. H. HOP.

535.313.08 : 531.793

154. The measurement of the radii of curvature of convex spherical surfaces by autocollimation. JUREK, B., AND KAUTSKY, F. *Rev. Opt. (Théor. Instrum.)* **27**, 369–70 (*June*, 1948) *In French.*—The difficulties encountered in the precision measurement of the radius of curvature, r, using objectives of small size and small numerical aperture, due to the high values attained by a in the formula $r = (D^2 - a^2)^{\frac{1}{2}}$, and to the slow change in quality of the returned image with displacement of the moving part of the instrument used, are discussed, and the errors they introduce examined experimentally. It is concluded that a should be made as small as possible, and the errors introduced by its non-zero value controlled by a modification of the microscope. S. W.

535.321.327

155. The temperature coefficient of the refractive index of water. HAWKES, J. B., AND ASTHEIMER, R. W. *J. Opt. Soc. Amer.*, **38**, 804–6 (*Sept.*, 1948).—A Jamin interferometer was used to measure the thermal coefficient of the refractive index of H_2O for sodium light ($\lambda = 5\,893$ Å) from -5°C to $+25$°C. From this was calculated the index-temperature curve over the same range. The results agree with those found by the Bureau of Standards for water within the experimental error, $1\times10^{-6} - 2\times10^{-6}$ index unit per deg. centigrade. No differences were found between H_2O samples from different sources, nor was any change observed in the same sample over periods of weeks. No anomalies or irregularities in behaviour were found in the average dn/dT. The possibility of a small consistent difference between the dn/dT *v.* T curves taken with rising and falling temperatures near 0°C is still under investigation. A.

535.321.53 : 535.81

156. Empirical relationships between the partial dispersions of the ordinary types of optical glasses. RANK, D. H. *J. Opt. Soc. Amer.*, **38**, 885–6 (*Oct.*, 1948).—Three empirical relationships have been derived between reciprocals of pairs of partial dispersions of the ordinary optical glasses. The relationships are of the form $X = a + bY + cY^2$ where X and Y are variable and a, b, and c the empirical constants. a, b, and c were determined by least squares making use of the data on sixteen optical glasses. The fit obtained appears to hold within the 5th place experimental error of the index determinations. Determination of N_D and N_h and the use of the three empirical relationships quoted above allows calculation of N_F, N_C, $N_{G'}$, and V in a simple manner. These relationships, however, do not apply to the barium glasses. A.

535.323 : 535.515 : 536.48

157. The optical constants of quartz at low temperature. BARBARON, M. *C.R. Acad. Sci., Paris*, **227**, 1443–4 (*May* 3, 1948) *In French.*—Using an apparatus to be described elsewhere, the changes in the optical constants of a quartz prism *in vacuo* at temperatures from 63 to 273°K have been determined with high accuracy. For $\lambda = 5\,460$ Å, the refractive index for

both the ordinary and extraordinary ray vary linearly with temperature, the slopes being $-5{\cdot}8\times10^{-4}$ and $6{\cdot}8\times10^{-4}$/deg. K respectively. The birefringence varies very little with temperature, the slope being of the order of 1×10^{-6}/deg. K. The dispersion appears to vary very little with temperature. W. F. B.

535.33.03 : 537.523.5

Spectroscopic studies of the electric arc at very low intensity. *See Abstr.* 236

535.33.072 : 522.611

158. A new ultra-rapid spectrograph. COJAN, J. *Ann. Astrophys.*, **10** (*No.* 1) 33–8 (1947) *In French.*—Optical details are given of an ultra-fast spectrograph, relative aperture $F/0{\cdot}65$, designed to record the night-sky spectrum. A new type photographic objective, $f = 16$ cm, gives twice the correction formerly obtained with an 8 cm lens over the wide spectral range, 4 000–7 600 Å. Used with two 50° prisms the objective gives a spectrum 1·25 cm long, the dispersion varying from 77 Å/mm at 4 000 Å to 860 Å/mm at 7 600 Å. D. R. B.

535.33.072 : 621.395.82

159. Reduction of noise. Perkin–Elmer infrared spectrophotometer recording system. CREITZ, C. *Analyt. Chem.*, **20**, 707–13 (*Aug.*, 1948).

535.33.072–15

160. A new industrial infra-red spectrometer. GORDON, R. R., POWELL, H., AND ISBELL, R. A. C. *J. Sci. Instrum. Phys. Ind.*, **25**, 277–82 (*Aug.*, 1948).—Quantitative analysis by means of infrared absorption methods has been limited in the past by having to calibrate each spectrometer for the materials on whose analysis it is to be used. It is shown that in the case of two spectrometers of nominally the same design, identical calibration curves of optical density versus concentration are obtained only when corrections are made for cell zero and scattered radiation. The effects of making these corrections are illustrated by the calibration curves for isobutane, *n*-butane and cyclohexane as determined on two instruments of identical design. The problem of correl ting spectrometers of differing design is also discussed. A detailed description is given of an industrial infra-red spectrometer. A.

535.338 : 539.133

161. The band spectrum of manganese hydride, MnH. III. Structure of the λ5207 band. NEVIN, T. E., AND DOYLE, P. J. *Proc. Roy. Irish Acad. A*, **52**, 35–50 (*Aug.*, 1948).—The rotational analysis of the 1,0 band of the $^7\Pi \rightarrow {}^7\Sigma$ system is reported. Values of some of the more important constants deduced from this and from earlier work [Abstr. 107 (1943); 1769 (1945)] are: $B'_v = 6{\cdot}425 - 0{\cdot}187(v' + \frac{1}{2})$; $r'_e = 1{\cdot}622$, $r''_e = 1{\cdot}724\times10^{-8}$ cm. Using values of $x_e\omega_e$ from the relation $x_e\omega_e = 3B_e$, the following rough formula for the P_1 heads is derived: $\nu = 17\,526 + 1\,652u' - 19{\cdot}3\,u'^2 - 1\,520\,u'' + 17{\cdot}1\,u''^2$, where $u = v + \frac{1}{2}$. Λ-type doubling and perturbations in the $^7\Pi$ state are discussed. R. F. B.

535.338 : 542.9

162. On a reaction mechanism involving the free radicals C_2, CCl and CBr. PANNETIER, G., AND LAFFITTE, P. *C.R. Acad. Sci., Paris*, **226**, 72–4 (*Jan.* 5, 1948) *In French.*—When Cl_2 is added to a flame of C_2N_2 burning in air or O_2, bands of CCl appear in the spectrum. This is attributed to reaction of C_2 with chlorine. Similarly, when Br_2 is added to the flame bands 2 913–2 935 Å are observed. A. G. G.

535.338.1 : 539.15

163. Measurement of transition probabilities in the titanium spectrum. VAN STEKELENBURG, L. H. M. *Univ. Utrecht Diss.* (*Keminky ein Zoon N.V.*) 80 *pp* (1948) *In Dutch.*—Investigation of the anodic d.c. arc spectrum of TiO_2 by Ornstein's method. The distribution of the atoms on the energy levels is satisfactorily described by the Maxwell–Boltzmann law and the temperature T entering that expression could be determined by measuring the intensity ratios in the CN-bands at 4 216 Å. The emission in the centre of the arc proved to be undisturbed by self-absorption or by emission in the outer regions. Thus it was possible to compute the relative A-values for a number of atomic as well as ionic lines. The agreement with King's experiments [Abstr. 537 (1938)] was within 7% for the triplet system, whereas somewhat higher values were obtained for the quintuplet system, which might be due to accidental factors in the set-up of King's experiments. The values found were also checked against Harrison's multiplet-values [Abstr. 1210 (1929)] and those computed on the multiplet-intensity rules. Prior to the determination of transition probabilities the convection velocity of the gas at the centre was determined for different current intensities, and this was found to depend on the current and the height above the lower electrode. The concentration of the ions present was calculated from current and field strength in the arc, and from the velocity of evaporation of Ki from the anode. The concentration of the Ti-atoms was then obtained by Saha's formula, and after a check of the calculated values against the experimental data, the transition probabilities for the ionic line $(Ag)_{3\,235} = 1{\cdot}8\times10^7$ and for the atomic line $(Ag)_{3\,355} = 1{\cdot}5\times10^6$ were found. The absolute transition probability for the atom is then obtained by multiplication by $1{\cdot}1\times10^4$, and for the ion by multiplication by $1{\cdot}8\times10^5$. A.

535.338.333

164. Spectrum of helium-3. BRADLEY, L. C., AND KUHN, H. Letter in *Nature, Lond.*, **162**, 412–13 (*Sept.* 11, 1948).—The spectra of samples containing He^3 in concentrations of 1 : 700 and 1 : 70 were measured with two Fabry–Pérot etalons in series. The He^3 satellite of the 5 015 Å line, $2^1S - 3^1P$, was clearly resolved, and was separated by $-0{\cdot}83 \pm 0{\cdot}03$ cm^{-1} from the He^4 line. This does not agree with the value $-0{\cdot}77$ cm^{-1} from Hughes and Eckerts theory [Abstr. 135 (1931)].

535.338.41 : 541.57

Spectroscopic determination of binding moments. *See Abstr.* 328

535.339

165. Optical method of obtaining strictly monochromatic radiation. BATARCHUKOVA, N. R. *Dokl. Akad. Nauk SSSR*, **58** (*No.* 6) 1013–16 (1947) *In Russian.*—Possibilities of separating superfine spectra lines due to isotopes and nuclear moments is considered, and an experimental optical method of isolation of the green line 5 086 Cd is described. A

silverplated molten optical quartz plate is used as the interference filter, its thickness being chosen to resolve the line completely. Fine thickness adjustment is obtained by temperature variation. This method is extended to other lines with narrow "Doppler width," like green 5 461 Hg, a multiplex interference spectroscope serving as a filter. A microphotogram shows that the resolution of some of the 12 constituents has been accomplished. The superfine lines corresponding to single isotopes yield a monochromatic radiation comparable to the one directly obtained from the isotope Hg^{198} in 1940. A. L.

535.34 : 537.312.5

166. On the absorption, light sensitivity and electrical conductivity of CdS layers. Weiss, K. *Z. Naturforsch.*, **2a**, 650–2 (*Nov.–Dec.*, 1947) *In German.*—By a new method (not described) the author has succeeded in obtaining control over the properties of thin layers of PbS, CdS and Sb_2S_3. Some layers have been produced which are practically insulators and hence, presumably, of stoichiometric composition. Others were well conducting and showed considerable sensitivity to light. CdS cells proved most sensitive and were used to detect radiation of 10^{-10} watt. The photo-current is proportional to the applied voltage. Infrared cut-off occurs at $\lambda = 520\ m\mu$. The electrical conductivity increases very slowly with temperature up to ~120°C and very rapidly above 200°C. H. K. H.

535.341

167. A new photoelectric absorptiometer. Humphrey, J. H., and Harris, E. J. *J. Sci. Instrum. Phys. Ind.*, **25**, 314–16 (*Sept.*, 1948).—Light from a single source passes alternately through two paths, one of which contains the test fluid and the other a calibrated grey wedge, and is then brought to a focus on a photocell. The alternating e.m.f., which is produced when there is any unbalance between the light energy transmitted through the two paths, is amplified by a tuned amplifier and is detected by headphones. The advantages of a null method which uses a single photocell are discussed. A.

535.341

168. In defense of Beer's law. Hardy, A. C., and Young, F. M. *J. Opt. Soc. Amer.*, **38**, 854–8 (*Oct.*, 1948).—To state that a substance fails to obey Beer's Law is an injustice, since it is the investigator who has failed to make proper use of the Law. If the substance becomes a mixture of substances when in solution, Beer's Law must be applied to each component of the mixture. It does not seem to be generally realized that this can often be done, even when none of the components of the mixture can be isolated in the pure state. A.

535.341–15 : 535.343.4–15

169. Infrared prism spectrometry from 24 to 40 microns. Plyler, E. K. *J. Res. Nat. Bur. Stand., Wash.*, **41**, 125–8 (*Aug.*, 1948).—A prism of thallium–bromide–iodide has been used to measure the transmission of various substances in the i.r. from 24 to 40 μ. The prism was installed in a Perkin–Elmer spectrometer, and a Golay detector was employed for measuring the energy. Transmission data were obtained for polystyrene, polyethylene, and different samples of TlBr–TlI. Also measurements have been made on the cut-off of KBr, AgCl, and other crystals. The rotational spectrum of the water-vapour molecule has been measured to 39·2 μ, and the known frequencies of these absorption bands have been used for the calibration of the prism. A.

535.343

170. Theory of the absorption spectrum of diphenyl. Davydov, A. S. *J. Exp. Theor. Phys.*, **18**, 201–9 (*Feb.*, 1948) *In Russian.*—The molecular spectrum of diphenyl is calculated by investigating the splitting-up of the energy levels of the phenyl groups. A.

535.345 : 535.61–15 : 666.1/.2

171. Measurements of transmission in the infra-red for a thick sample of window glass at low and at high temperatures. Escher-Désrivières, J. *C.R. Acad. Sci., Paris*, **226**, 1359–61 (*April* 26, 1948) *In French.*—Gives spectral transmission curves over the range 0·7 to 2·4 μ for a sample of window glass 6·9 cm thick. Curves are given for the temperatures 10°, 500° and 650°C. There is a pronounced absorption band at 1·1 μ and another less pronounced at about 2 μ. The absorption tends to shift towards a longer wavelength as the temperature is raised. J. W. T. W.

535.345 : 539.215

172. The transmission of powder films in the infra-red. Henry, R. L. *J. Opt. Soc. Amer.*, **38**, 775–89 (*Sept.*, 1948).—Infra-red transmission measurements on dry films of quartz and ZnS powders are presented. The effects of particle size, layer thickness, and the optical constants of the materials are discussed. A.

535.345.6 : 536.52

173. A blue glass for approximate colour-temperature and intensity measurements. Harding, H. G. W. *J. Sci. Instrum. Phys. Ind.*, **25**, 333–5 (*Sept.*, 1948).—A description is given of the colorimetric properties of Chance OB.9 blue glass which has been made for obtaining the approximate colour-temperatures and intensities of light sources using tungsten filament lamps at lower colour-temperatures as standards. The spectral transmission and the colours for various illuminants, together with the energy matching and ageing properties of the glass, are given. A method is outlined by which a colour-temperature can be assigned to the colour of a filter with a colour-temperature step from 2 250°K to about 2 850°K so that the colour-temperature steps of such filters can be calculated from the spectral transmission curves. Methods of using the glass for colour-temperature measurement are given. A.

535.347 : 538.615 : 541.182

174. Magnetic dichroism of colloidal solutions of ferric hydroxide. Boutaric, A., and Bourgin, R. *C.R. Acad. Sci., Paris*, **226**, 2142–4 (*June* 28, 1948) *In French.*—The dichroism of colloidal ferric hydroxide has been investigated under different conditions. For a solution of fixed concentration the dichroism increases with field strength up to a limiting value. Using a saturating field strength the dichroism increases with concentration, passes through a maximum and then decreases. When the colloidal solution is mixed with quantities of KCl, insufficient to produce coagulation, the dichroism is reduced as KCl con-

centration is increased but does not vary with time. The influence of mixing the ferric hydroxide solution with an equal volume of N KCl and diluting with H_2O has been followed. The dichroism of a flocculated suspension diminishes rapidly with time. W. R. A.

535.37

175. The origin and composition of different types of luminescence of CaS . SrS . CeSmLa phosphors. Levshin, V. L. *Dokl. Akad. Nauk SSSR*, **58** (*No.* 5) 779–82 (1947) *In Russian.*—There are 3 types of luminescence: (1) at the moment of excitation, (2) phosphorescence decaying after excitation, (3) flash when an excited phosphor is irradiated with long-wave rays—the most characteristic being the latter type. The author suggested in 1942 that phosphors examined had energetic levels of various depth; electrons at relatively shallow traps are transferred at about 300°K by thermal motion into the conductivity zone giving rise to phosphorescence by re-combination; deep-trap electrons can rise to the conductivity zone only by the action of infrared radiation or by strong heating. This suggestion is proved by a series of experiments. Three diagrams and two tables are included dealing with (1) the main characteristics of luminescence at excitation or flash; (2) the existence of separate phosphorescence and flash energy levels; (3) the correlation between the numbers of phosphorescence and flash energy levels, and the probability of these levels being occupied; and (4) the nature of the excitation luminescence. F. L.

535.37 : 539.132

176. A luminescent cadmium silicate. Levialdi, A., and Luzzati, V. *J. Phys. Radium* (*Sér.* 8) **9**, 306–12 (*Oct.*); 341–4 (*Nov.*, 1948) *In French.*— This phosphor, like many others, shows a much greater inertia to saturation at first excitation than at succeeding ones. Even weeks after the first excitation the difference is marked even after heating to 280°C before the second excitation. Although the phosphor is very stable it is considered that the difference is due to a photochemical change. The efficiency was found to increase with intensity of excitation both with this phosphor and with willemite. From a number of excitation curves with different intensities, all on virgin samples, it was found that $y_i(t) = y_h(k_{ih} \cdot t)$ where y_i, y_h are the emissions for any two curves at times t and $k_{ih} \cdot t$, k_{ih} being a constant for any pair of curves. If the phosphor is excited to saturation, heated for some time at a definite temperature, cooled and re-excited, it is found that $y_\infty - y_i(t) = k_{ih}[y_\infty - y_h(t)]$, k_{ih} now having another value. Since the second excitation reaches saturation almost instantaneously, the area $(y_\infty - y) : t$ must represent the luminous energy liberated by the heating. After heating for 10 minutes at various temperatures curves are plotted showing difference of such areas for every 50°C against temperature. These show a large maximum at 200°C and a small one at 400°C. Assuming that the emission is proportional to the number of empty traps, and that the mean life τ in any trap is equal to the time of heating, it is deduced from the Randall relation $\tau = s^{-1} \cdot \varepsilon^{-E/k\tau}$, and assuming $s = 10^{8 \pm 1}$, that the trap depth for the 400°C maximum is $1{\cdot}44 \pm 0{\cdot}13$ eV. Curves of excitation were also obtained after first excitation to saturation, heating, excitation for a short time and later continuing th excitation. It was found that any curve coincid with any other if displaced by the difference in tim of the short interrupted excitation. The excitatio spectra appeared to be the same for successiv excitations. The effects are discussed theoretically. J.

535.37 : 539.132 : 548.

177. Luminescence of zinc cadmium sulphides Non-luminous electron transitions. Multiple collision Peyrou, C. *Ann. Phys., Paris* (*Sér.* 12) **3**, 459–50 (*July–Aug.*, 1948) *In French.*—The first part review the current theories of luminescence with particula attention to the quantum inefficiency—implyin transitions without luminous radiation. Möglic and Rompe's explanation of these transitions is dis cussed, with its suggestion of loss of energy by simu taneous multiple vibration quanta absorbed by th lattice. The probability of such a mechanism $\propto (T)^{E/h\nu}$ where E is the energy jump of the electro and ν is the mean frequency of the lattice. The secon part deals with experiments on the intensity o luminescence of numerous ZnCd-sulphides as $f(T)$ The effects are in qualitative agreement with th Möglich–Rompe theory [Abstr. 1391 (1941)]. Further the Riehl [Abstr. 2860 (1940)] effect, i.e. the variatio of efficiency with intensity of excitation, was studied particularly at the theoretically critical very lo intensities. The Riehl effect might be explained b the assumption that the radiationless transitions ar monomolecular. It disappears at low temperatures since there are no longer such transitions. The third part is a theoretical attempt to distinguish between the consequences of bimolecular and monomolecula radiationless transitions. It is pointed out that though the variation of efficiency with temperature follows the law $(T)^a$, the exponent derived from the experimenta curves lies between 9 and 13, whereas the theoretica value $\simeq 50$, assuming that the radiationless tran sition occurs from the conduction band to the uppermost filled band or to the impurity level jus above it. J. E

535.37

178. Storing of the light sum in infrared-sensitive phosphors. Morgenstern, Z. L. *Dokl. Akad. Nauk SSSR*, **58** (*No.* 5) 783–6 (1947) *In Russian.*—One more paper to prove that for phosphors of the CaS . SrS + Ce . Sm type the light sum under infrared stimulation is always $\sim 5 \times$ that under thermal stimulation [Abstr. 2094 (1946)]. F. L

535.371 : 548.

179. The nature of the centres of luminescence o photochemically coloured alkali-halide crystals. Katz M. L. *J. Exp. Theor. Phys.*, **18**, 164–73 (*Feb.*, 1948 *In Russian.*—The dependence of the luminescence o NaCl and KCl crystals on the concentration of the centres of coloration was investigated and it wa found that the effect is not due to the fortuitou admixture of foreign atoms, but to optical and thermal dissociation of the *F*-centres. The relative number of *F*-centres dissociated with u.v. emission, fo fluorescence, phosphorescence, thermoluminescence and luminescence under plastic deformation, wa determined, and a theory of the mechanism o

luminescence of coloured alkali-halide crystals attempted. A.

535.372

180. Luminescence spectra of ZnO. VERGUNAS, F. I., AND GAVRILOV, F. F. *J. Exp. Theor. Phys.*, **18**, 224–7 (*Feb.*, 1948) *In Russian.*—The investigation of the spectra of ZnO after varying preliminary heat treatments, characterized by different values of the distance V between the atom levels of Zn and the zone of conductivity at high and low temperatures, showed the existence of several bands, whereas only one band appears where V has the same value at high and low temperatures. It is also shown that the spectra may be altered by heating the ZnO to different temperatures, which confirms Kutzelnigg's prediction that the colour of the ZnO luminescence depends on the way in which it is obtained and on the preliminary thermal treatment [*Monatsschr. d. Chem.*, **61**, 69 (1932)]. A.

535.372 : 535.61–31

181. The fluorescence of uranium trioxide hydrates. VIER, D. T., SCHULTZ, M. L., AND BIGELEISEN, J. *J. Opt. Soc. Amer.*, **38**, 811–14 (*Sept.*, 1948).—The hydrates of UO_3 have been found to be fluorescent when exposed to u.v. light. The fluorescence spectra of the different hydrates have been measured. The anhydrous oxides do not fluoresce. A.

535.372 : 541.141.13

182. Absorption of light by organoluminophor molecules in metastable conditions, and photochemical reactions showing quadratic relationship to the light intensity. SVESHNIKOV, B. Y., AND DIKUN, P. P. *Dokl. Akad. Nauk SSSR*, **59** (*No.* 1) 37–40 (1948) *In Russian.*—Reference is made to the work of G. Lewis, D. Lipkin and T. Magel [Abstr. 2182 (1942)]. Analogous absorptiometric measurements have been carried out, but in the ultraviolet region, the same fluorescein-activated borate phosphor having been used. No relationship obtains between the absorption of Hg lines 3 660, 3 340, 3 130 and 2 650 Å, and the intensity of irradiating light. The percentage of molecules in metastable conditions was estimated from the absorption change for the Hg line 4 360 Å, unfiltered light being used for excitation, or from the phosphorescence saturation curve when filtered light was used. It has been found that the transition of a molecule into a metastable condition has no effect on absorption in the second or third absorption zone. The discrepancy in this respect between the first and subsequent zones is explained by assuming double quantum absorption in the ultraviolet region. Photochemical changes in borate phosphors activated with α-nitronaphthalene and fluorescein have been examined in order to verify that the hypothesis of double quantum absorption referred to above leads to quadratic relationship between photochemical action and intensity of light. F. L.

535.372 : 548.0 : 536.48

183. Ultra-violet luminescence of KCl and KBr monocrystals, under X-rays at low temperatures. KATZ, M. L. *Dokl. Akad. Nauk SSSR*, **58** (*No.* 9) 1935–8 (1947) *In Russian.*—It is shown that luminescence intensity changes with temperature increase of NaCl crystals after irradiation by X-rays at liquid air stage can be used for investigation of the energy spectrum of the local energy levels in the crystal. The lumin. intensity shows sharp peaks at discrete temperatures corresponding to local levels of different depth. This method is being applied to KCl and KBr crystals and extended to ultraviolet spectra. The experimental technique employing photon counters with Pt-sensitized photocathodes is described in detail. The results are analysed, and the mechanism of luminescence release by electron liberation from the conducting zone B into local F-levels is traced. The ultraviolet luminescence is explained by the recombination of F-level electrons with the positive "vacancy" in the A zone (top level). A theoretical explanation of the luminescence intensity jumps is also given (filling up of the local L_1, L_2 . . . levels). A. L.

535.375 : 539.153

184. Influence of the electron distribution on the localization levels in luminescence phenomena of CaS . SrS(Ce, Sm, La)-phosphors, and number of repeated localizations of electrons. LEVSHIN, V. L. *J. Exp. Theor. Phys.*, **18**, 149–63 (*Feb.*, 1948) *In Russian.*—It is shown that the development of various luminescence processes of these phosphors depends not only on the number of centres of ionization and the corresponding number of localized electrons, but also on the distribution of the electrons on the levels of localization; the localization bands show a considerable energetic width. It is seen that the number of repeated electron localizations cannot be large. The phenomenon of repeated flashes and phosphorescence is considered in greater detail. Eventually the method of calculating the increase of total intensity of flashing and phosphorescence at intense excitation, and of the infrared irradiation of phosphors is explained. A.

535.375.5

185. Polarization of the combination diffraction lines. WOLKENSTEIN, M. V. *J. Exp. Theor. Phys.*, **18**, 138–48 (*Feb.*, 1948) *In Russian.*—The valence-optical scheme permits approximate general laws of polarization to be established materially agreeing with Placzek's rules. The experimental confirmation of these laws is demonstrated. A.

535.375.5 : 535.361

186. A new method for the analysis of light diffused by powdered crystals. CABANNES, J., LENNUIER, R., AND HARRAND, M. *C.R. Acad. Sci., Paris*, **223**, 301–3 (*Aug.* 12, 1946) *In French.*—The light may be observed either by reflection or transmission, but in each case a Raman spectrum must be carefully photographed, and a monochromatic source of light is essential. Apparatus is described for observing the diffuse radiation by transmission along the axis of the incident beam without the use of any filter [see Abstr. 1169 (1935)]. L. S. G.

535.375.5 : 541.632

187. Hindered rotation. IV. Raman spectrum of deuterated ethyl bromides. LANGSETH, A., AND BAK, B. *K. Danske Vidensk Selsk. Mat-fys. Medd.*, **24** (*No.* 3) 16 *pp.* (1948) *In English.*—The Raman spectra of $CH_3 . CH_2Br$, $CH_3 . CHDBr$, $CH_2D . CH_2Br$ and $CD_3 . CD_2Br$ were measured. The third substance is shown to be a mixture of two spectroscopically different rotational isomers. The difference is not due to there being one deuterium atom in

the molecule, since the second substance does not show the same effect. It is brought about by the destruction of the trigonal symmetry, and rotational isomerism is thought to be responsible. The intensity-ratio of corresponding lines due to the two rotational isomers strongly supports the assumption of a three-minimum potential curve for the internal rotation about the C–C bond. A. C. M.

535.375.51 : 535.35

188. Direct proof of the flashing effect of the excitation light on SrS + Eu, Sm phosphors. TRAPEZNIKOVA, Z. A. *Dokl. Akad. Nauk SSSR*, **58** (*No.* 5) 791–4 (1947) *In Russian.*—The flashing effect brought about by an optical excitant in the case of the SrS + Eu, Sm phosphors (10^4, 10^5 Sr atoms to one Eu or Sm atom, without flux) has been measured quantitatively. It has been found that $L_v > L_{uv}$, i.e. the light sum under visible excitation was much larger than that under ultraviolet excitation. Irrespective of the previous amount of the stored light sum, the light sum is either increased or reduced to the value corresponding to L_{uv} following a subsequent irradiation with ultraviolet light. The probability of recombination with radiation is approx. 1·8 times less with ultraviolet than with infrared excitation. Introducing a second activator (Sm) is responsible for the increase of the light sum. F. L.

535.39

189. On the suppression of reflection from absorbing substances by means of one, or two, thin transparent films. ABELÈS, F. *C.R. Acad. Sci., Paris*, **226**, 1259–61 (*April* 19, 1948) *In French.*—It is shown that, with known transparent materials reflection from a metal surface can only be suppressed for the case of very oblique incidence. A method is given by means of which it is possible to find for what substances a given pair of transparent materials will suppress reflection. H. H. HOP.

535.39 : 535.225 : 533.7

190. On the non-existence, in reflection, of a spectral broadening due to Doppler effect of thermal agitation. LENNUIER, R. *C.R. Acad. Sci., Paris*, **226**, 708–9 (*March* 1, 1948) *In French.*—It is shown that, as only the molecules in a very thin layer are effective in reflection, this broadening is of the same order as the natural line width. L. P.

535.39 : 535.225 : 533.7

191. Observations on the paper by R. Lennuier relative to the impossibility in the reflection of light of a spectral broadening due to Doppler effect of thermal agitation. CABANNES, J. *C.R. Acad. Sci., Paris*, **226**, 710–11 (*March* 1, 1948) *In French.*—From Maxwell's equations it may be proved that molecular movements can have an effect only on the diffused light. Experiments are described which prove the non-existence of the phenomenon in regular reflection. L. P.

535.393

192. Optical properties of metals. CARRELLI, A. *Atti R. Accad. d'Italia* (*Mem. Classe Sci. Fis. Mat. Nat.*) **11** (*No.* 7) 315–24 (1940) *In Italian.*—It is shown that the results of measurements of metal reflectivity in visible and infrared light are not completely explained by electron theory. An improved agreement might be obtained by assuming that the electron damping is not independent of the wavelength of the incident light. G. R.

535.393 : 535.87

193. The optical properties of Ni, Co, Fe, Mn, and Cd. BUECHE, F. *J. Opt. Soc. Amer.*, **38**, 806–10 (*Sept.*, 1948).—The reflectivities for evaporated metal films of Ni, Co, Fe, Mn and Cd have been measured at 5 angles of incidence in the visible and near infra-red regions. From this data, the dielectric constant and conductivity of the metals were found by the method of Collins and Bock [Abstr. 2176 (1943)]. These data are shown graphically. A technique is described for obtaining smooth evaporated mirrors. A.

535.42

194. Diffraction of light from sources of finite dimensions. GODFREY, G. H. *Aust. J. Sci. Res. A*, **1**, 1–17 (*March*, 1948).—The distribution of light intensity in the diffraction pattern of continuous light sources is treated analytically for Fraunhofer diffraction phenomena. Sources and diffracting apertures of any dimensions are first discussed, and a result of general application is derived which relates the illumination and dimensions of the diffraction pattern to the dimensions of the source and aperture. A source consisting of a luminous strip is considered in more detail, the form of the pattern is derived for such a source, and tables are supplied to facilitate numerical evaluation. Consideration is given to the maxima and minima of intensity in the image, and the conditions under which these are observable are indicated. Faint but visually discernible fringes associated with the image of a strip when viewed through a narrow slit are recorded and are in agreement with the theory. Applications to the optics of the telescope and spectroscope are discussed.

535.42

195. Huygens' principle and diffraction. VASSEUR, J.-P. *C.R. Acad. Sci., Paris*, **225**, 885–6 (*March* 15, 1948) *In French.*—An interpretation of Kottler's theory of the nature of the secondary sources in the cases of opaque and reflecting screens containing a small hole. H. H. HOP.

535.42

196. Diffraction of light by a perfectly black infinite half-plane. DURAND, E. *C.R. Acad. Sci., Paris*, **227**, 1440–2 (*May* 3, 1948) *In French.*—This classical problem is solved, in the Kirchhoff approximation, by means of a Fourier transformation. The formula obtained gives the same intensity as the usual Fresnel method, and also the correct value for the phase, which in Fresnel's theory is wrong by $\pi/4$. L. P.

535.434/.435–4 : 541.64

197. Depolarization of light by scattering in dissolved polymers. FRISMAN, E., AND TSVETKOV, V. *J. Exp. Theor. Phys.*, **18**, 126–37 (*Feb.*, 1948) *In Russian.*—Rubber-like polymers in solution were investigated in varying conditions of polarization. In partially polymerized styrol and methyl methacrylate the anisotropy of the scattering particles showed a steep decrease right from the appearance of a polymerized fraction in the system. The dependence of depolarization on concentration in polystyrol and high-molecular isobutylene (oppanol) solutions was studied, and poly-isobutylene solutions exhibited a

Krishnan effect, indicating the presence of big molecular agglomerations in the system. It is concluded that the macromolecules act as diffracting centres, being optically isotropic, independent of the optical properties of the monomer parts of the chain. From this is inferred that the chain itself is twisted irregularly into the shape of a ball or knot. A.

535.5.08 : 535.247.4

198. Photoelectric method of measuring the degree of polarization of radiation. TUMERMAN, L. A. *Dokl. Akad. Nauk SSSR*, **58** (*No.* 9) 1945–8 (1947) *In Russian.*—The classical methods of Cornu and Savart as well as the Lyot [Abstr. 2323 (1926)] modification of the Savart method measure the so-called coefficient of depolarization of radiation $\Delta = I_M/I_m$, the constant relative error being 1–2%. This coefficient is a convenient characteristic of a partially polarized radiation provided its value is not too near to 1, i.e. when the radiation is more or less polarized. On the other hand, with feebly polarized light it is preferable to characterize radiation by the degree of polarization $p = (I_M - I_m)/(I_M + I_m) = (1 - \Delta)/(1 + \Delta)$. Differentiating this equation, the absolute, and relative, determination error, respectively, are obtained: $\delta p = \pm \frac{1 - p^2}{2} \frac{\delta\Delta}{\Delta}$; $\frac{\delta p}{p} = \pm \frac{1 - p^2}{2p} \frac{\delta\Delta}{\Delta}$. Hence, for small values of p, the value of the relative error can become unduly large. Differential photoelectric photometry measures the difference $I_M - I_m$, hence p can be determined with any desired relative error, with a sufficiently sensitive receiver. In the method used a beam of partially polarized radiation passed through a rotating analyser. The constant component of the photocurrent was thus $\propto (I_M + I_m)$ while the amplitude of the variable component $\propto (I_M - I_m)$. A compensation method was used. The results of polarization measurements of fluorescein in fluorescein solutions (aqueous and in water-glycerol mixtures) of various concentrations, and excited by wavelengths 436 and 365 mμ, have been compared. According to the theory advanced by Vavilov [*J. Exp. Theo. Phys.*, **13** (1943)], the ratio p_{436}/p_{365} should remain constant for all concentration values. This should also apply to rotatory depolarization caused, e.g. by the decrease of the viscosity of the solvent. Both have been confirmed by experiment. F. L.

535.51 : 535.89

199. A comparative survey of some possible systems of polarized headlights. BILLINGS, B. H., AND LAND, E. H. *J. Opt. Soc. Amer.*, **38**, 819–29 (*Oct.*, 1948).—In a polarizing headlight system polarizers are placed on automobile headlights and in a viewer before the eyes of automobile drivers. These polarizers are so oriented that the viewer is crossed with the headlights of an approaching car. This blocks most of the light from approaching headlights. The amount of the polarized component of the reflected light from an object illuminated by a car's headlights which is transmitted back through the viewer in the same car depends on the type and orientation of the polarizers. Thus objects have different brightness depending on the polarizing system being used. Similarly, the contrast between objects and their background will be different for different polarizing systems. In this paper some basic matrices of an optical calculus are derived, and used to show the orientation of the headlights and viewer polarizers for all possible polarizing systems. For each of these systems the relative brightness of a specularly reflecting object is determined. Finally, equations are derived for the contrast of various types of objects with their background and a few special cases are calculated. A.

535.566.2

200. Rotatory power of camphor dissolved in phenol. PARIAUD, J.-C., AND CHAPAS, G. *C.R. Acad. Sci., Paris*, **226**, 1361–3 (*April* 26, 1948) *In French.*—The rotatory power of camphor dissolved in phenol decreases with increasing molecular proportions of phenol, and increases with temperature. The addition of water to the camphor/phenol mixture neutralizes the effect of the phenol to a considerable extent. A mechanism for the formation of a labile compound of camphor and phenol is proposed. C. B. A.

535.642 : 535.653.32

201. Syntheses of spectral-distribution curves. BREWER, W. L., AND HOLLY, F. R., JR. *J. Opt. Soc. Amer.*, **38**, 858–74 (*Oct.*, 1948).—A method is presented for obtaining spectral distributions having colorimetric characteristics which have been pre-specified in terms of a set of tristimulus values or trichromatic coefficients. The distributions may be chosen to correspond to energy radiated from light sources, or to the transmittances or reflectances of materials acting on such energy. Tables and figures are included to facilitate a rapid solution to any given problem. Several examples are given which illustrate the method and indicate the kinds of applications possible. A.

535.82 : 537.531

Formation of optical images by X-rays. *See Abstr.* 240

535.89 : 539.16.08

202. A cloud chamber illumination system. LOFGREN, E. J., NEY, E. P., AND OPPENHEIMER, F. Letter in *Rev. Sci. Instrum.*, **19**, 271 (*April*, 1948).—A compound cylindrical lens for use with a line source discharge lamp for cloud chamber illumination is described. The new component is a large aperture cylinder immediately surrounding the source, which is located at a distance r/μ from the axis of the cylinder (r = radius, μ = refractive index, of cylinder). It is stated that 60% of the light is brought into the forward beam. J. G. W.

535.89 : 621.325.53 : 537.527.5

A light-source for continuous radiation of great intensity. *See Abstr.* 238

HEAT 536

536.2.01/.02 : 517.947.43

203. A new solution of Fourier's equation. RIBAUD, G. *C.R. Acad. Sci., Paris*, **226**, 140–2 (*Jan.* 12, 1948) *In French.* **The problem of the infinite wall with constant heat flow.** RIBAUD, G. *Ibid.*, 204–6 (*Jan.* 19, 1948) *In French.*—The equation of linear flow of heat has a solution of the form $\theta = t^m f(z)$, where

$z = x/\sqrt{4at}$, $a = \lambda/c\rho$, Cauchy's solution $\theta = f(z)$ being a particular case. In the application of this solution to the problem of the infinitely extended wall with constant heat flow, $m = \frac{1}{2}$, and f is determined by the equation $f''' + 2zf'' = 0$ and the boundary conditions $f(0) = 1$, $f(\infty) = f'(\infty) = f''(\infty) = 0$. The solution representing a constant heat flow, Φ, is then given by $\theta = \frac{\Phi}{\lambda\sqrt{\pi}}\sqrt{(4at)}f(z)$. Numerical values of $f(z)$ are given from $z = 0$ to $z = 2$. G. G.

536.2.01/.02 : 517.947.43

204. Developments of a solution of the equation of Fourier in the case of a wall of infinite thickness. RIBAUD, G. *C.R. Acad. Sci., Paris*, **226**, 449–51 (*Feb.* 9, 1948) *In French.*—In extension of results given in previous papers [Abstr. 203 (1949)] the form of f_m in the solution, $\theta = t^m f_m(z)$, is determined for values of m, positive and negative, for which $2m$ is a whole number. The solutions apply to the problem of heat flow in a wall receiving a heat flux varying with the time. G. G.

536.2.083 : 53.082.73 : 621.3.012.8

205. Measurement of temperature distribution by electrical models. MOELLER, F. *Arch. tech. Messen, Issue* 152 (*Ref. V24–1*) *T6* (*July*, 1947) *In German.*—The relation between the corresponding thermal and electrical quantities is deduced. The construction of equivalent circuits using lumped heat resistances is explained and applied to heating of cables in ducts. Transient heat distribution taking thermal capacity into account is considered and applied to d.c. machines and transformers on short circuit and overload. Distributed heat resistances are represented by metal plates or foils of suitable conductivities and some applications are given. V. W. R.

536.24 : 517.947.43

206. On the problem of cooling of a sphere. PARODI, H. *C.R. Acad. Sci., Paris*, **223**, 540–2 (*Oct.* 7, 1946) *In French.*—The temperature distribution, θ, satisfies $\partial^2\theta/\partial r^2 + 2r^{-1}\partial\theta/\partial r = h^{-1}\partial\theta/\partial t$. This equation is solved, subject to various conditions, in the form of a series. L. S. G.

536.24 : 517.949.43 : 517.949.2

207. An extension of the method of finite differences to the calculation of spherically symmetrical temperature distributions. SCHWAN, H. *Z. Naturforsch.*, **2a**, 678–82 (*Nov.–Dec.*, 1947) *In German.*—From an arbitrarily given initial symmetrical distribution of heat, or arbitrary conditions of heat supply or withdrawal, the temperature field within and without a sphere is determined by a step-by-step process involving finite differences in the space and time co-ordinates. The fundamental differential equations of heat flow yield recurrence formulae for temperature changes in function of the space and time co-ordinates. The variation of temperature with time at any point of space may then be determined by a graphical process. 2 cases are considered: (1) The medium surrounding the sphere remains at a constant temperature; (2) The external medium has a conductivity differing from that of the sphere and is free from convection currents. In problems involving steady heat supply the method is applied to the period before a steady state of temperature is established within the medium, and yields results in agreement with the direct solution representing final steady conditions. G. G.

536.248 : 537.29

208. On the problem of the effect of electric fields on the heat transfer of gases. SENFTLEBEN, H., AND GLADISCH, H. *Naturwiss*, **34** (*No.* 6) 187–8 (1947) *In German.*—Continuation of Abstr. 5190 (1936). The additional heat transfer Q caused by an electric field E across a horizontal cylindrical capacitor is given by the theoretical formula:

$$Q = A \cdot \frac{C_p \Delta T^2 \left(\alpha + \frac{2\mu^2}{3kT}\right)}{T^3\eta} \times E^2p^2\left[1 + B\frac{\Delta T\left(\alpha + \frac{2\mu^2}{3kT}\right)}{T^2\eta}E^2p + \ldots\right]$$

where p = pressure, T = absol. temperature, C_p = molar heat, α = polarizability, μ = dipole moment, k = Boltzmann constant, η = viscosity and A and B constants depending on the geometry. The square bracket is $\simeq 1$ for a gas with no dipole molecules. Experiments with air, CO_2 and various saturated, unsaturated and chlorinated hydrocarbons can be represented by $Q = aE^2p[1 + bE^2p]$ for dipole gases and by $Q = aE^2p[1 + cE^2]$ for gases with no dipoles, where a, b, c are constants. Whereas the former expression agrees with the theoretical formula, the small term cE^2 in the latter expression is not accounted for. However, neglecting this term, fairly good values of α and μ can be obtained by comparison of the theoretical and experimental formulae, using literature values for C_p and η. [See also Abstr. 3506 (1947), 1462–3 (1948)]. H. L.

536.421.4 : 532.77

209. Freezing point lowering of heavy water. CHANG, T.-L., AND CHU, T.-C. *Sci. Rep. Nat. Tsing Hua Univ.*, **4** (*Nos* 4–6) 361–2 (1947) *In English.*—The molal freezing point lowering of D_2O was observed as 2·00°, agreeing well with the calculated value 2·004°. A.

536.422.1 : 669.018

210. A method for the evaporation of alloys. HARRIS, L., AND SIEGEL, B. M. *J. Appl. Phys.*, **19**, 739–41 (*Aug.*, 1948).—A method for the evaporation of alloys in high vacuum which from the nature of the procedure used should be applicable to all alloys which are not refractory. The method has been tested on α-brass and β-brass and on a Au–Cd alloy. These alloys have components whose vapour pressures are very different and yet chemical and electron diffraction analyses on the evaporated brass alloys and chemical analysis on the evaporated Cd–Au alloy show that the composition of the original alloy is held to within close limits. A.

536.423.4/.45 : 551.574

211. Invisible condensation. MASSON, H. *Rev. Sci., Paris*, **85**, 1126–30 (*Dec.* 1 *and* 15, 1947) *In French.*—It is here considered that water in the atmosphere has been absorbed by the surface without the dew point being reached in a layer of air accessible to observation. The amount of condensed water varies with the

nature of the substance. The results of measurements made on linen, cotton, filter paper and Leick plates in a room where the relative humidity is 60–65% are given. For a mass, n, of water absorbed in a hygrometric state, e, of the air, a relation $n = Ae^p$ is obtained where A and p are constants characteristic of the substance used and the nature of the exposed surface. This holds for the initial stage of absorption by the surface, but a slower rate of absorption follows as if the surface were saturated and a very thin layer of saturated vapour existed above it. Minute amounts of dew may then form, this stage being called "precocious dew." As this thin layer of air widens the stage proper to dew formation is reached. R. S. R.

536.48 : 531.19 : 533.7

Kinetic equations in the theory of super-fluidity. *See Abstr.* 115

536.48 : 539.155.2

Concentration of He^3 by evaporation of liquid helium at temperatures below the λ-point. *See Abstr.* 276

536.52 : 535.345.6

Blue glass for colour-temperature and measurements. *See Abstr.* 173

536.521 : 537.523.5

Spectroscopic measurements of the temperature of, and electron pressures in, carbon arcs. *See Abstr.* 237

536.54 : 621.317.39

212. Compensation of temperature elements. Gordon, W. E., and Seay, P. A. *Bull. Amer. Met. Soc.*, **29**, 41–2 (*Jan.*, 1948).—Abstr. 118 B (1949).

536.581.2

213. A multi-temperature metal block thermostat. Howlett, F., and Marsden, R. J. B. *J. Sci. Instrum. Phys. Ind.*, **25**, 311–13 (*Sept.*, 1948).—The principle of Searle's bar is used to provide a series of thermostatically controlled cavities in which reaction vessels can be placed. One end of a large aluminium alloy bar, bored transversely to give the cavities, is heated electrically; the other end is cooled with water and the whole bar is thermally insulated. A linear temperature gradient is established which remains constant with time. A.

536.62

214. Measurement of energy of ignition in the calorimetric bomb. Brunelli, B., and Mandò, M. *Nuovo Cim.*, **5**, 167–72 (*June*, 1948) *In Italian.*—A method is described for the measurement of the "ignition energy" in bomb calorimetry. A big storage battery is directly connected, for the ignition, to the fuse wire, so as to ensure a constant potential difference at its leads. A ballistic galvanometer, suitably shunted (shunt $< 0{\cdot}01\ \Omega$), is only inserted to measure $q = \int i dt$, whence the ignition energy $Q = Eq/J$ follows. The method enables Q to be measured at every single combustion, without giving rise to any of the objections of the methods previously used; it has proved to be simple and reliable. Some experimental observations are added. A.

536.63 : 541.11

215. The specific heats of a chemical compound in the liquid and solid states in the neighbourhood of the melting point: heat of fusion and heat of association. Procopiu, S. *C.R. Acad. Sci., Paris*, **226**, 1001–2 (*March* 22, 1948) *In French.*—From the author's result [*C.R. Acad. Sci., Paris*, **223**, 503 (1946) and Abstr. 2114 (1948)] that the ratio of the molecular heat, LM, and the temperature, T, of fusion is 2 for simple elements, and is n, the number of atoms/molecule, for certain chemical compounds, it is shown that $M(c_l - c_s) = 2$ or n, where c_l and c_s are the specific heats of the liquid and solid respectively. For organic acids and alcohols it is necessary to introduce, in addition, the heat of association, A, and the relation $A = (c_l - c_s)T - L$ is derived. The observed values for several elements, chemical compounds, organic acids and alcohols are shown to fit these relations. (L = latent ht., M = mol. ωt.) S. W.

536.633.3 : 53.082.4 : 53.082.7

216. On the determination of the ratio of specific heats of gases by an electro-acoustic method. Bouchard, J. *C.R. Acad. Sci., Paris*, **226**, 1434–6 (*May* 3, 1948) *In French.*—A modified electroacoustic method for determining the ratio of specific heats γ from the velocity of sound in a gas is described, resonance in the tube being detected not by ear or microphone but by its reaction on the telephone diaphragm emitting the sound. The impedance of the circuit including the interrupter is a minimum at maximum resonance. A cathode ray oscillograph gives the waveform and precise frequency and ensures absence of harmonics in determining the ½-wavelength. The method is also applicable to free air. Values of γ for air of 1·395 in a 4·5 cm tube and 1·403 in free air were obtained, but the method is of most value in studying variations of γ, by using a closed tube, to avoid leakage, determining resonance values for various frequencies, and comparing with values for a known gas. W. C. M.

THERMODYNAMICS 536.7/.8

536.7

217. The principles of reciprocity and of superposition in thermo-mechanics. Verschaffelt, J. E. *Bull. Acad. R. Belge Cl. Sci.*, **34** (*No.* 2) 126–51 (1948) *In French.*—In 1942 the author formulated a principle termed the "principle of superposition" applicable to irreversible processes. According to this, the energy dissipated in any complex irreversible process is the sum of the energies dissipated in the elementary processes which together make up the complete complex process. The "principle of reciprocity" was formulated in 1931 by Onsager. The general validity of neither of these principles can be demonstrated, but a verification of their truth in a number of special cases leads one to anticipate them to be of general application. In the absence of any general proof of the principles, it is of interest to see if they are in accord with one another. The author shows that this is so, conditionally at least. F. E. H.

536.7 : 533.6.011.1 : 536.23

218. The thermodynamics of gas flow. Madelung, E. *Ann. Phys., Lpz.* (*Folge* 5) **43** (*Nos* 6–7) 417–20 (1943) *In German.*—The question "how does the motion of a small quantum of gas change its temperature?" is solved by combining thermodynamics, hydrodynamics and heat conduction theory. The following concept is formed: The gas is first cooled by adiabatic expansion. The resulting heat of friction,

taken over the whole gas stream, exactly compensates the cooling for an ideal gas. However, the cooling is found more equally distributed than the heating, which proceeds from the regions of max. velocity gradient near the walls. For laminar flow the axial filaments of gas flow are colder than the outer ones, but the average total heat, taken over the whole section, remains constant. V. W. R.

536.7 : 538.11

The thermodynamics of magnetization. *See Abstr.* 257

536.758 : 536.72

219. Remarks on the Boltzmann formula relating to periodic systems. DE BROGLIE, L. *C.R. Acad. Sci., Paris*, **223**, 298–301 (*Aug.* 12, 1946) *In French.*—The formula, $\delta Q = r\delta A$, expressing the variation of the heat supplied to a system with the action (integral) is related to Boltzmann's formula, $S = k \log P$, connecting the entropy and probability, by suitably defining these latter terms for a periodic system. L. S. G.

536.763 : 536.423.15 : 532.612.4

220. Contribution to the physical chemistry of liquids. Internal pressure, vapour pressure and surface tension of liquids. DE CARVALHO, H. G. *An. Acad. Brasil. Cienc.*, **20** (*No.* 1) 75–94 (1948) *In Portuguese.*—Divergent results for the internal pressure of a liquid are obtained from different thermodynamic expressions, as internal pressure, (1) is related by empirical equations to surface tension and molecular volume, (2) latent heat of vaporization is related to surface tension. This latter relation is applied to Clapeyron's equation for the vapour pressure of a liquid in orthobaric equilibrium with its vapour. [See also H. G. de Carvalho, *An. Ass. Quim. Brasil*, **5**, 49 (1946)]. Experimental checks with benzene, ethylacetate, carbon tetrachloride and ethyl ether show agreement over a wide range, almost to the critical point. A. C. C.

ELECTRICITY 537

THEORY . ELECTRONS 537.1

537.12 : 538.3

221. The magnetic moment of the electron. KOPPE, H. Letter in *Z. Naturforsch.*, **3a**, 124–5 (*Feb.*, 1948) *In German.*—A (virtual) electron pair has a resultant magnetic moment even though the spins are opposed. Thus the electromagnetic vacuum is paramagnetic and this implies an anomalous magnetic moment $\delta\mu$ of the electron. Elementary calculation gives a divergent result $\propto \int r^{-5} dr$. If the lower limit is cut off at the electron radius, then $\delta\mu/\mu = 0{\cdot}08$. Though much larger than the experimental value, it is very sensitive to the approximations made. By the same argument, a magnetic quadrupole moment is predicted for the electron. G. J. K.

537.12 : 621.384.6 : 535.14

Spectrum of radiation by electrons in a circular accelerator. *See Abstr.* 146

537.122 : 537.311.33

222. The migration of electrons into alkali halide crystals. KARABASCHEFF, N. *Z. Phys.*, **118** (*Nos* 11–12) 718–26 (1942) *In German.*—KBr crystals a used to make models of boundary layer rectifier Colour spots are formed when the electrons diffu through the crystal and temporarily combine wi +ve metal ions, and the electron conduction is thu made visible. The additional current during migra tion of the electrons into the crystals increases c time; while $di/dt \propto$ (voltage)^2. The mechanism c electron diffusion in an electric field is mathematicall and experimentally investigated. V. W. I

ELECTROSTATICS . DIELECTRICS 537.2

537.226.

223. The dielectric properties of barium tetratitanat and other dielectrics of the system TiO_2–BaC SKANAVI, G. I. *Dokl. Akad. Nauk SSSR*, **59** (*No.* 1 41–4 (1948) *In Russian.*—Graph of dielectric constan ε at 50 c/s and 3 Mc/s against composition of th system TiO_2–BaO indicates four types of behaviour (1) Material approx. $BaTiO_3$ with perovskite structur for which ε is 130–7 000 and sharply dependent o temperature (graph). Increase of % BaO moves max of ε to lower temp. and reduces it; increase of % TiO moves max. to higher temp. and also reduces it (2) Material approx. barium tetratitanate, $BaO.4TiO_2$ with a distinct X-ray pattern. ε is 28–50 with a very small temp. coefficient, a loss tangent of 0·0005 from $10^5 - 5\times10^7$ c/s and with a spec. resistivity o 10^5 ohm-cm; these properties make such materials useful for condenser fillings. (3) Dielectrics with low BaO content having a rutile structure, ε up to 1 00 below 10 000 c/s where $d\varepsilon/dT$ is large and positive, and ε nearer 100 at 10 Mc/s with $d\varepsilon/dT$ negative: some relaxation phenomenon must be involved. (4) High BaO content when the material is chemically un stable and ε is 10–30. D. H. W.

537.226.8 : 539.319 : 621.3.017.143

224. Dielectric losses and internal stresses in alkali-halide crystals. SIKORSKY, J. A. *C.R. Acad. Sci. URSS*, **54** (*No.* 4) 315–16 (1946) *In English.*—Specimens $5\times10\times10$ mm cut out from KCl, KI and NaCl crystals were polished on silk and annealed in an electric crucible. The dielectric losses on annealing were studied. Annealing of KCl crystals at 200°C increased the loss by 50%, while annealing of KI crystals at 500°C reduced the loss to 50%. The dielectric losses were then measured for crystals annealed at various temperatures in the range 30°C to 550°C. The results are given in graphical form. In other experiments it was found that the dielectric losses of a crystal increase when the internal stress increases, and it is suggested that annealing affects the loss through the consequent change in internal stress. L. S. G.

537.228 : 537.533

225. Action of an electrostatic field on the surface of mercury. BERTEIN, F. *J. Phys. Radium* (*Sér.* 8) **8**, 352–7 (*Dec.*, 1947) *In French.*—A study is made of the behaviour of a Hg surface when subjected to a constant electric field. It is shown that if the field is sufficiently strong the electrostatic pressure produces a breakdown of equilibrium, which should have a

profound effect on discharge phenomena such as cold emission from Hg *in vacuo*. F. LL. J.

537.228.3 : 539.133 : 548–15

226. Dipole moments of molecules of some liquid crystals and electric double refraction of their solutions. TSVETKOV, V., AND MARININ, V. *J. Exp. Theor. Phys.*, **18**, 641–50 (*July*, 1948) *In Russian.*—Determination of the dielectric constants of solutions of 7 substances capable of forming liquid crystals, in parallel with the investigation of the electric double refraction of the same solutions. The values of the dipole moments of the molecules obtained in the dielectric investigation were compared with the corresponding values of the electro-optical constant of the dissolved substances, and by means of this comparison the angle between the molecular dipole moment and the molecule axis could be computed. Comparison of the structural characteristics of the molecules with the dielectric properties of the corresponding liquid crystals shows that negative dielectric anisotropy is exhibited by liquid crystals, the molecules of which have a dipole nearly at right angles to the molecule axis, whereas anisotropic liquid substances, the dielectric anisotropy of which is positive, are characterized by a small angle between the dipole moment and molecule axis. Negative dielectric anisotropy is apparently due to anisotropic rotation of the molecular dipoles, positive, to an anisotropic polarizability of the molecules. A.

537.228.5

227. On the influence of electrostatic fields on light, according to J. Stark. KUNZE, P., AND HOHL, L. *Ann. Phys., Lpz.* (*Folge* 6) **2** (*Nos* 5–6) 270–2 (1948) *In German.*—The possibility of deflecting a ray of light by a strongly inhomogeneous electric field ($dE/dr \simeq 10^{11}$ V/cm²) was investigated. The negative result agrees with current estimates of the order of magnitude of quadratic terms in Maxwell's equations. L. P.

ELECTRIC CONDUCTION . CURRENTS 537.3

537.311.33 : 548.0

228. A new conception of electronic conductivity in ionic crystals. PEKAR, S. I. *J. Exp. Theor. Phys.*, **18**, 105–9 (*Feb.*, 1948) *In Russian.*—The motion of polarons in an external electric field must be analogous to that of negative charges obeying Ohm's law. Since the concentration of equilibrium of polarons is much higher than that of the electrons in the zone of conductivity, and the polaron mobility is sufficiently high, it is the polarons (and not the electrons of the zone) which must be the true carriers of current (at least at moderately high temperatures). The mobility of the current carriers as determined experimentally (i.e. the product of conductivity into Hall's constant) agrees with the calculated value of the polaron mobility. A.

537.311.33 : 621.315.59

229. Modulation of conductance of thin films of semiconductors by surface charges. SHOCKLEY, W., AND PEARSON, G. L. Letter in *Phys. Rev.*, **74**, 232–3 (*July* 15, 1948).—A charge induced at the surface of a semi-conductor exists partly in surface levels and partly as a space charge within a narrow surface region (Schottky exhaustion layer.) The magnitude of the space charge depends on the electric field at the surface. If the thickness of the semi-conductor is comparable with the width of the space charge region, changes in the electric field will give rise to an adjustment of the space charge conditions which can have an appreciable effect on the resistivity of the semiconducting film. This effect has been experimentally demonstrated. The semi-conductor was used as one electrode of a parallel plate capacitor, and its resistivity measured parallel to the surface of the dielectric. H. K. H.

537.312.5 : 535.34

Electrical conductivity of CdS layers. *See Abstr.* 166

537.312.5 : 621.383.42

230. On the use of selenium photocells at low illumination levels and the dark currents following an illumination. TERRIEN, J., AND MOREAU, H. *Rev. Opt.* (*Théor. Instrum.*) **27**, 295–302 (*May*, 1948) *In French.*—A time lag and residual current (r.c.) in Se photo-e.m.f. cells does not obey the logarithmic law. The r.c. $\simeq \frac{1}{10}$ of the photocurrent for an illumination of 0·0003 lux, but is $\gtrsim$ 1/1 000 of the photocurrent at illumination levels of 3 lux so that the r.c. is never discovered at such levels of illumination. The r.c. increases at first with the illumination and then decreases sharply. This relation depends on, and varies with, the duration of the irradiation and the interval between the removal of the light source and the moment of the measurement. The r.c. also changes its direction, some times 3 times during the 1st min. after extinction of the source. R.c. were noticed even 24 hr after irradiation. An external voltage across the cell suppresses temporarily the r.c., but it reappears a little later. At levels of 10 lux the measurements are exact to 1/5 000. At levels of 1 lux this figure is 1/1 000. The use of Se photo-e.m.f. cells for the measurement of low intensity light sources is discouraged in favour of the photo-emissive cell. W. S.

537.312.6 : 538.221 : 536.48

231. Electric conductivity of ferromagnetics at low temperatures. VONSOVSKY, S. V. *J. Exp. Theor. Phys.*, **18**, 219–23 (*Feb.*, 1948) *In Russian.*—An approximate model of a ferromagnetic, in which the "outer" *s*-electrons are treated differently from the "inner" *d*-electrons which cause spontaneous magnetization, enables electric resistance to be calculated at low temperatures. It is shown that the collisions of *s*-electrons with "ferromagnons" ("spin waves" of the *d*-electrons) at magnetizations nearing saturation (for temperatures $\ll$ Curie point) result in an additional electric resistance characteristic for ferromagnetics, $\propto T^3$. A.

537.312.62

232. The electrodynamic behaviour of superconductors. HEISENBERG, W. *Z. Naturforsch.*, **3a**, 65–75 (*Feb.*, 1948) *In German.*—The electrodynamic behaviour of the author's model of superconductivity [Abstr. 3203 (1947)] is examined in detail. Calculation of the constant of superconductivity λ gives the correct temperature-dependence of this quantity. It is now related to the residual resistance in the

normal state. The derivation of the Meissner effect is attempted on different lines, making use of the existence of the spontaneous current threads. The thermal conductivity is reduced by the freezing of the electrons into the electron lattice. H. L.

537.363 : 541.133.1

A preparative electrophoresis apparatus. *See Abstr.* 323

ELECTRIC DISCHARGES 537.52

537.52 : 621.3.015.5

233. Optical investigations on the breakdown mechanism of gases. I. STRIGEL, R. *Arch. tech. Messen, Issue No.* 154 (*Ref. V*63–3) *T*52–4 (*April*, 1948) *In German.*—A résumé is given of published information on optical measuring methods published up to 1939. A short reference to the method of photographing the development of a spark by chopping the applied voltage by means of a parallel gap is followed by illustrated descriptions of 2 forms of the Boys camera. Two examples of the Wilson chamber are given with a detailed description of a modern construction and its electrical circuit capable of photographing spark phenomena down to 1 μsec duration. For all the preceding instruments the results obtained are illustrated by examples with a brief discussion of their contribution to the knowledge of the mechanism of the gas discharge. R. H. G.

537.52 : 621.3.015.5

234. Optical investigations on the breakdown mechanism of gases. II. STRIGEL, R. *Arch. tech. Messen, Issue No.* 154 (*Ref. V*63–4) *T*55–6 (*April*, 1948) *In German.*—The foregoing survey is continued by discussing investigations of the sparkover time lag by electro-optical means using a Kerr cell and a Nicol prism. The optical and the electrical component parts of the measuring circuit are discussed and a method of measuring the effective time of opening of the device is examined. The results obtained are illustrated by an investigation of the static breakdown of a 40 mm air gap. R. H. G.

537.523.3 : 621.3.015.532

235. Theory of bipolar corona on wires. POPKOV, V. I. *Dokl. Akad. Nauk SSSR*, **58** (*No.* 5) 799–802 (1947) *In Russian.*—Under constant voltage conditions the corona discharge from 2 parallel wires of opposite polarity is associated with a considerably greater current than that of a unipolar discharge, a fact indicating the interaction of two such discharges. The effect is usually explained by the neutralization of ionic charges of opposite signs in the external zone. Kaptsov [Abstr. 2749 (1937)], however, associated the interaction with the penetration of ions from the external zone into the coronal layer immediately surrounding each conductor. The author's measurements of voltage-gradient and ion density distribution indicate that both phenomena occur simultaneously. Expressions are developed on this basis for the corona current and power loss, showing good agreement with the experimental results. B. H.

537.523.5 : 535.33.03

236. Spectroscopic studies of the electric arc at very low intensity. JANIN, J., AND EYRAUD, C. *C.R. Acad. Sci., Paris*, **227**, 523–4 (*Sept.* 6, 1948) *In French.*—Phenomena in an arc between Pt electrodes (3 mm apart, 30 mA at 550 V) are described. R. F. B.

537.523.5 : 536.521

237. Spectroscopic measurements of the temperature of, and electron pressures in, carbon arcs. HULDT, L. *Ark. Mat. Astr. Fys.*, **36A** (*Paper* 3) 17 *pp.* (1948) *In German.*—Describes measurements of excitation temps. in 5–10 A carbon arcs, the electrodes of which were loaded with Cu or Ba salts. The excitation temps. varied from 3 670°C to 5 430°C. Electron pressures (deduced from Saha's equation) were determined from measurements of the relative intensities of Ba I and Ba II lines. J. D. C.

537.527.5 : 535.89 : 621.325.53

238. A light source for continuous radiation of great intensity. SCHULZ, P. *Z. Naturforsch.*, **2a**, 583–4 (*Oct.*, 1947) *In German.*—Describes two forms of source, using 40 atmos. Xe, for currents of 8 and 30 A respectively. The cathodes are rotatable. The efficiencies are 3 and 3·3 Hefner candles/watt, and the emission spectra show continua in the u.v. and visible, but lines in the infrared. J. D. C.

X-RAYS 537.531

537.531

239. The spectral energy distribution of X-ray target radiation. KULENKAMPFF, H., AND SCHMIDT, L. *Ann. Phys., Lpz.* (*Folge* 5) **43** (*Nos* 6–7) 494–512 (1943) *In German.*—The spectral energy distribution of the X-ray radiation from a W target was determined by an ionization spectrometer for voltages between 20–50 kV. The absorption of X-rays in the target, spectrometer, etc., was separately determined and the corrected spectral distribution deduced. The equations for spectral distribution found by Kulenkampff [Abstr. 1588 (1923)] for voltages between 7–12 kV were still found valid for the higher voltages. The rediffusion of electrons from the target produces a non-linear energy distribution. The radiation from a thin layer is calculated and found in qualitative accordance with Sommerfeld's theory. V. W. R.

537.531 : 535.82

240. Formation of optical images by X-rays. KIRKPATRICK, P., AND BAEZ, A. V. *J. Opt. Soc. Amer.*, **38**, 766–74 (*Sept.*, 1948).—Several conceivable methods for the formation of optical images by X-rays are considered, and a method employing concave mirrors is adopted as the most promising. A concave spherical mirror receiving radiation at grazing incidence (a necessary arrangement with X-rays) images a point into a line in accordance with a focal length $f = Ri/2$ where R is the radius of curvature and i the grazing angle. The image is subject to an aberration such that a ray reflected at the periphery of the mirror misses the focal point of central rays by a distance given approximately by $S = 1{\cdot}5Mr^2/R$, where M is the magnification of the image and r is the radius of the mirror face. The theoretically possible resolving power is such as to resolve point objects separated by about 70 Å, a limit which is independent of the wavelength used. Point images of points and therefore extended images of extended objects may be produced

by causing the radiation to reflect from two concave mirrors in series. Sample results are presented. A.

CATHODE RAYS
POSITIVE RAYS 537.533/.534

537.533 : 538.565 : 621.384

241. A process aiding the capture of electrons injected into a betatron. KERST, D. W. Letter in *Phys. Rev.*, **74**, 503–4 (*Aug.* 15, 1948).—Abstr. 163 B (1948).

537.533.72 : 539.165.2

Magnetic spectrograph of caustic type for electrino particles. *See Abstr.* 286

537.533.73 : 537.531

242. On a new way of studying the energy relations in electron diffraction patterns. VON FRIESEN, S. *Ark. Mat. Astr. Fys.*, **35A** (*Paper* 18) 26 *pp.* (1948) *In English.*—Electron diffraction images from metal foils are recorded by the X-rays produced by the impact of the electrons on a thin sheet of metal, as previously described [Abstr. 2747 (1947)]. By the use of suitable filters it is possible to distinguish between background electrons which have suffered a change in wavelength and those whose wavelength remains unchanged. In the case of Al it is deduced that the mean loss of energy of the background electrons $\geq$ 50 eV at 30 keV (0·17%). A Cd sheet was used, the filters being Sb and Te. J. T.

537.534 : 539.155.2

243. Sources of error in the measurement of doublets by the mass spectrograph. II. EWALD, H. *Z. Naturforsch.*, **3a**, 114–24 (*Feb.*, 1948) *In German.*—[See Abstr. 663 (1948)]. Beams of different ions passing through a narrow slit have different spreading angles, and usually the spreading is unsymmetrical. The error in doublet measurement due to this is considered. A. J. M.

DISCHARGE TUBES . COUNTERS 537.54

537.542

244. A note on ethylene self-quenching G.-M. counters. MORGANSTERN, K. H., COWAN, C. L., AND HUGHES, A. L. Letter in *Phys. Rev.*, **74**, 499–500 (*Aug.* 15, 1948).—The effects of various quenching gases on the characteristics of A-filled counters have been investigated. Ethylene consistently gave better results than alcohol as the quenching gas, and was found most satisfactory with a partial pressure of 0·8 to 5 cm. No multiple counts were observed. R. W. P.

537.542

245. Some Geiger–Müller and proportional counters of spherical shape. SALVINI, G. *Rev. Sci. Instrum.*, **19**, 494–6 (*Aug.*, 1948).—A Geiger–Müller counter with a spherically shaped cathode is described. The pulse shape from this counter is similar to that of cylindrical counters. It may be used satisfactorily in ordinary coincidence work. Some of the counters, slightly modified to avoid spurious discharge, were filled with BF_3 and used as proportional counters for detection of neutrons. A.

IONIZATION . THERMIONICS 537.56/.58

537.564 : 551.510.535

Balance equations of the ionospheric charge carriers. *See Abstr.* 355

537.585

246. Mass-spectroscopical investigation of negative halide ion formation in interactions of halide salts with an incandescent tungsten surface. IONOV, N. I. *J. Exp. Theor. Phys.*, **18**, 174–86 (*Feb.*, 1948) *In Russian.*—The investigation was made with NaCl, KCl, RbCl, CsCl, KI, KBr, KF, WCl_6, and $ThCl_4$ molecules formed by surface ionization on incandescent W. In all cases negative atom ions of the halide entering the system of the salt were found. In the ionization of $ThCl_4$, Cl_2^- ions were formed in addition to the Cl^- ions. The temperature-dependence of the −ve atomic ion formation follows a thermodynamic relation similar to the Saha–Langmuir formula. From the experimental ratio of the positive ionic currents of the alkali metals to the negative halide ion currents the energy values of electron affinity of the halide atoms could be determined. In the case of the molecular ion of chlorine, Cl_2^- the value lies between 2·7 and 3·7 eV. A.

COSMIC RAYS 537.591

537.591

247. Positive excess of the meson component at sea level at varying zenithal heights. BALLARIO, C., BENINI, M., AND CALAMAI, G. *Nuovo Cim.*, **5**, 187–95 (*June*, 1948) *In Italian.*—The mesonic component positive excess at sea level and at different zenithal heights was measured by using a counter telescope having magnetic lenses like those used by Bernardini [Abstr. 142 (1941)]. Vertical measurements gave the instrument effect δ in good agreement with that deduced by preceding authors. Another series of measurements was made for particles of both signs at various zenithal heights, the first lens being a converging and the second a diverging lens. Effects σ_+ and σ_- showing the percentage of positive and negative particles of rather slow energies in the mesonic spectrum, have been calculated. If a positive excess of 20% uniformly distributed in the energy spectrum is supposed, experimental results, δ, σ_+ and σ_-, and a comparison with the calculations indicates that the excess is not uniformly distributed but decreases with the increasing of meson creation energy. A value of 6% positive excess, if supposed uniformly distributed, is given by calculations so that the experimental results for a zenithal height of 60° could be explained. The experimental results seem to show that the frequency of creation by protons must increase with the creation energy of the mesons or that there is a considerable creation process by a non-ionizing radiation. A.

537.591

248. The mass-spectrum of varitrons at a height of 3 250 m above sea level. ALICHANIAN, A., WEISSENBERG, A., KHARITONOV, V., AND DAYON, M. *Dokl. Akad. Nauk SSSR*, **60** (*No.* 9) 1515–18 (1948) *In Russian.*—By modification of the apparatus previously used in 1946 whereby the resolving power is doubled a series of experiments were carried out on Mt. Alagez in 1947 on varitrons. All the trajectories obtained can be divided into two groups, viz. trajectories of particles stopped in one of the three absorbers in the apparatus and trajectories of particles passing through all three absorbers. Only the former are considered in this paper. Diffraction spectra are obtained the maxima of which correspond to definite masses for the varitrons. These spectra are compared with results obtained using the original apparatus, and tables are included of varitrons found by both methods. As a result of the increased resolving power of the modified apparatus two particles of masses 100 and 150 m_e were detected. W. H.

537.591 : 539.18

249. Wilson chamber study bearing on the hypothesis of a light intermediate particle ("λ meson") in air showers. DAUDIN, J. *J. Phys. Radium* (*Sér.* 8) **9**, 137–42 (*April*, 1948) *In French.*—Cloud chamber photographs in a large chamber containing a 1·5 cm lead plate and operated by a counter array sensitive to extensive air showers have been examined. While the numbers of particles in showers initiated in the lead plate are in agreement with cascade theory, the angular dispersion and the penetration of the particles are considered to indicate an effective critical energy higher than that of cascade theory, and hence to agree with the postulate of shower particles of greater than electronic mass. J. G. W.

537.591 : 539.18

250. On the existence of particles with greater than mesotron mass. NIKITIN, S. Y. *J. Exp. Theor. Phys.*, **18**, 577–602 (*July*, 1948) *In Russian.*—Gives the results of the application of a method for measuring the ionizing effects of relativistic particles. The ionization spectra of cosmic radiation particles were investigated at 3 200 m above sea level. In the range of soft components 3 groups of particles showed ionizing capacities of respectively 1·3, 1·8 and 2·7 × that of mesotrons. This and the corresponding path lengths of the particles led to an estimate of the masses at (300–500), (700–1 100) and (2 000–3 500) m_e resp., while the incidence ratio was ~ 0·15% of the number of mesotrons. A.

537.591 : 539.185 : 551.51

251. The neutron density in the free atmosphere up to 67 000 feet. YUAN, L. C. L. Letter in *Phys. Rev.*, **74**, 504–5 (*Aug.* 15, 1948).—Two identical BF_3 proportional counters (96% B^{10}) were carried to 67 000 ft using free balloons, one being shielded with 0·03 in Cd and the other with a similar Sn shield. A maximum was found for both counters at 7 cm Hg pressure, while for slow neutrons ($E < 0{\cdot}4$ eV) a maximum at 9 cm Hg pressure was obtained by difference. The low-altitude exponent of mass absorption (~150 g/cm²) is found to hold up to 18 cm Hg pressure. J. G. W.

537.591.1 : 539.152.1

252. Cosmic rays and the nuclear structure of atoms. WAMBACHER, H. *Öst. Chem.-Ztg.*, **43**, 116–21 (1940) *In German.*—A summary of the phenomena of cosmic rays and their significance in the interpretation of nuclear structure. B. A.

537.591.15

253. The nature of narrow atmospheric showers. KUTCHAY, S. A., AND ROSENTAL, I. L. *Dokl Akad. Nauk SSSR*, **60** (*No.* 9) 1523–6 (1948) *In Russian.*—Under reference to earlier work by Alichanian and others experiments are described, made on the Pamir at 3 860 m above sea level. It is concluded from these that narrow showers contain a great number of light particles, which is impossible to explain by cascade multiplication and the most probable explanation is that the origin of the light particles, presumably photons, is not due to a cascade process nor to trivial electromagnetic interaction. L. J. G.

537.591.15

254. Structure of the penetrating cosmic ray showers. BELL, L. N. *J. Exp. Theor. Phys.*, **18**, 249–58 (*March*, 1948) *In Russian.*—The method applied was that of plane-proportional counters. The results obtained contradict the hypothesis of the existence of a distinct type of penetrating showers and point to the presence of a genetic connection between these showers and Auger's general type of showers. The observed coincidences cannot be explained by the high-energy electrons of the Auger showers, which only obey the cascade rules. A series of observations proves that the particles observed under Pb are formed in the latter. A.

537.591.15

255. Investigation of the penetrating power of particles of atmospheric showers of cosmic rays. ZATSEPIN, G. T., AND EIDUS, L. KH. *J. Exp. Theor. Phys.*, **18**, 259–67 (*March*, 1948) *In Russian.*—The absorption in Pb and Al was observed by counters at a height of 3 860 m above sea level. The particles of showers penetrating 12 cm Pb were identified with the electron-photon high-energy component of Auger's showers. Some indications of the existence of extensive meson showers of a low density were obtained. From the investigation of the penetrating power of the particles of the localized (narrow) showers the existence of two types of particles constituting these showers could be concluded. A.

537.591.15

256. Density spectrum of extensive air showers. LOVERDO, A., AND DAUDIN, J. *J. Phys. Radium* (*Sér.* 8) **9**, 134–6 (*April*, 1948) *In French.*—The density spectrum of extensive air showers was investigated at Pic du Midi (2 900 m) with particular reference to the regions of low density, the unit counter group having areas up to 2 500 cm². Measurements were made for separations of 4 m and 50 m, and, as is reasonable, the reduction of shower rate between 4 m and 50 m is found to be less at low densities than at high densities. J. G. W.

MAGNETISM 538

538.11 : 536.7

257. The thermodynamics of magnetization. LIVENS, G. H. *Proc. Camb. Phil. Soc.*, **44** (*Pt* 4) 534–45

(1948).—A re-examination of the subject was made to link ideas suggested during the last 2 decades with the original ideas of Larmor. The traditional interpretation of the dynamical relations of the magnetic field, based on the assumption that H_α is the fundamental vector of the field, is incompatible with a strict dynamical theory of these affairs. But the alternative form of the relations, based on B_α as the field intensity vector, appears to be entirely satisfactory in this respect. The thermodynamic relations, formulated since, and without reference to, Larmor's original discussion, prove, when properly interpreted in terms of the new dynamical field functions, to be identical with this discussion, interpreted however with the induction vector B_α as the magnetic force intensity. The whole discussion can be formulated with complete generality to cover the whole range of static phenomena under the most generally conceivable conditions which the physical science of matter in bulk admits, with the single exception that it still fails to allow for the important effects of hysteresis. Among other results the discussion provides complete generalizations, applicable to crystalline media, for the Curie–Langevin and Curie–Weiss equations of magnetic state, the latter being obtained by simple energy considerations independently of any hypothesis about local molecular fields. A.

538.214 : 539.153

258. The magnetic susceptibility of uranium tetrafluoride UF_4. ELLIOTT, N. Letter in *Phys. Rev.*, **74**, 498–9 (*Aug.* 15, 1948).—The magnetic susceptibility of UF_4 has been measured by a Gouy balance from 74·5–294·5°K and throughout this range it follows the Weiss–Curie law. The magnetic moment of U^{+2} has been deduced as 2·83 Bohr magnetons. The experimental results suggest that the U^{+2} ion is in a $^3F_2$ state and basic states for it probably belong to the configuration, $5f^2$, $5f6d$, or $6d^2$. Magnetic evidence does not provide a direct answer to the question of the spectroscopic state of the U^{+2} ion in UF_4. W. R. A.

538.22 : 538.114

259. On the relation between Barkhausen effect and Rayleigh's law. MONTALENTI, G. *Nuovo Cim.*, **5**, 154–61 (*June*, 1948) *In Italian.*—The author experimentally proves that Rayleigh's law for magnetic materials subjected to magnetic forces low by comparison with the values of the maximum coercive force, ceases being valid at that force value at which the Barkhausen effect takes place. Such tests have been performed on ordinary soft iron, commercial pure iron, carbon steel, hard and annealed nickel, Hipernik (50 Ni, 50 Fe). For Si steel, too, whose anomalous behaviour as to the Rayleigh law is well known, it is possible to find, on the plot of the permeability against the magnetic force, a point which characterizes the force at which the threshold of the Barkhausen effect is reached, i.e. the point at which the concavity towards the abscissa ends. The number of the materials examined is small compared with the total number of magnetic materials, but since they belong to substantially different types, the following conclusion seems justified: the validity of the law up to that force at which the Barkhausen effect appears is a general property of magnetic materials. Néel has lately given a theoretical interpretation of the Rayleigh law. The fundamental hypothesis on which it is based is that the magnetic force, to which the fragment of material is subjected, must be small enough not to cause reversals or changes of directions of magnetization in Weiss domains. The reported tests confirm the validity of Néel's hypothesis. A.

538.22 : 538.114 : 539.23

260. Particular aspects of the magnetization of thin ferromagnetic films. DRIGO, A., AND PIZZO, M. *Nuovo Cim.*, **5**, 196–206 (*June*, 1948) *In Italian.*—The theories of ferromagnetism as applied to ferromagnetic samples, at least one dimension of which should be comparable to the thickness of the elementary domains, lead us to expect the change of many of the magnetic properties characteristic of these materials in their massive condition. With this point in view the authors have undertaken a series of researches intended to establish the behaviour of thin films of Fe, Co and Ni. On these the characteristics of the magnetization curve and the discontinuities of Barkhausen have been studied. A variation progressive with that of the thickness of the coercive field and of the residual magnetization was found. More interesting is the study of discontinuities, which disappear with thickness of $1·2\times10^{-5}$ cm for Co, $0·8\times10^{-5}$ cm for Ni and $1·3\times10^{-5}$ cm for Fe, in accordance, therefore, with the critical value theoretically established by Kittel. Other results of the study of Barkhausen discontinuities, which may be useful to explain certain properties of elementary domains, are described. A.

538.221 : 536.48 : 537.312.6

Electric conductivity of ferromagnetics at low temperatures. *See Abstr.* 231

538.27

261. Thermal variation of spontaneous magnetization. GUILLAUD, C. *C.R. Acad. Sci., Paris*, **223**, 1110–12 (*Dec.* 23, 1946) *In French.*—Spontaneous magnetization, σ_s, in a ferromagnetic material is that which exists in the absence of an external field but under the influence of the molecular field. σ_s was determined at different temperatures, T, for Mn_4N, Mn_2Sb, Fe_4N, CrTe, CrO_2, MnAs and MnP. If σ_0 is the spontaneous magnetization at 0°K, σ_s/σ_0 was plotted against T/θ (θ being the Curie point). Magnetization curves obtained theoretically are also plotted and their relation to the former is discussed. The thermal variation is related to the crystal structure. L. S. G.

ELECTROMAGNETISM . ELECTRODYNAMICS
538.3/.5

538.31

262. An anomaly in electromagnetic theory. CULLWICK, E. G. Letter in *Nature, Lond.*, **161**, 969–70 (*June* 19, 1948). Also HOWE, G. W. O. *Wireless Engr*, **25**, 273–4 (*Sept.*, 1948).—If an electric charge in uniform motion passes close to a stationary close-conducting loop, an e.m.f. and current will be induced in the loop. But if the loop moves and the charge is stationary, Maxwell–Lorentz theory gives zero-induced e.m.f. In the first case the induction of

current is inconsistent with the principle of conservation of energy; the theory of Ritz gives equal e.m.f.'s in the 2 cases but the energy principle is again violated. These problems are discussed.

538.312 : 512.974/.5 : 535.51

263. Circular polarization and the rotation operator of the Maxwell field. VALATIN, J. G. *C.R. Acad. Sci., Paris*, **227**, 110–12 (*July* 12, 1948) *In French.*—Maxwell's equations can be put into operator form $i\partial\phi/\partial t = c\,\mathrm{rot}(\varepsilon\phi)$ where $\phi = (iE, H)$ has six components. Rot here represents an operator in the form of a 6-dimensional matrix, which is equivalent to the usual vector operator, and ε changes the components iE of ϕ into $-H$, and vice versa. The eigenvalues of ε are ± 1, corresponding to right- and left-handed circular polarization. G. J. K.

538.56

264. On electromagnetic spherical waves. SOROKIN, V. *J. Exp. Theor. Phys.*, **18**, 228–35 (*Feb.*, 1948) *In Russian.*—By means of spherical harmonics of vector character, spherical electromagnetic waves *in vacuo* and in the electromagnetic field of multipoles may be represented by simple expressions obtained by elementary methods. A.

538.566 : 621.392.26

265. On the propagation of plane waves in a rectilinear metal guide of arbitrary cross-section. RIGAL, R., AND VOGE, J. *C.R. Acad. Sci., Paris*, **226**, 326–8 (*Jan.* 26, 1948) *In French.*—The properties of these waves are derived from a general solution of the wave equation. L. P.

538.566 : 621.392.26

266. Structure of a wave of phase velocity *c*. ABRAGAM, A. *C.R. Acad. Sci., Paris*, **226**, 1356–7 (*April* 26, 1948) *In French.*—In view of possible applications to linear accelerators, several results are established for the propagation of a wave of phase velocity c in a guide of arbitrary cross-section. The most general wave depends on four arbitrary functions. A particle of velocity $\simeq c$ experiences in the guide a transverse force (vanishing in the case of circular symmetry) and there is no focusing. L. P.

538.566.3 : 551.594.6 : 621.396.812.3

267. On the reasons for a change in the amplitude of a single impulse reflected from the ionosphere. GUSEV, V. D. *Izv. Akad. Nauk SSSR Ser. Fiz.*, **11** (*No.* 2) 195–201 (1947) *In Russian.*—Problems pertaining to the inhomogeneous structure of the *E*-layer are examined. The existence in this layer of electron clots, i.e. electron clouds of dimensions > wavelength, is assumed, and the diffraction of radio waves by the inhomogeneities of the *E*-layer considered. This explains (1) the fading effect known as diffraction fading and (2) the abnormally large values of the reflection coefficient in *E*- or F_2-layer reflection. Confirmation was obtained by sustained measurements of the reflection coefficient of waves of 3 and 4 Mc/s frequency vertically incident on the ionosphere. A.

538.566.3 : 551.594.6 : 621.396.11

268. On magneto-ionic refraction in the sporadic *E* layer. DRIATSKY, V. M. *Dokl. Akad. Nauk SSSR*, **58** (*No.* 5) 775–8 (1947) *In Russian.*—Double and triple refraction have been observed at Tiksi Bay (71° 35′ N, 128° 55′ E), chiefly at night, in winter and under disturbed magnetic conditions. For triple refraction, mean difference of 23 observations between critical frequencies of the two extraordinary rays is calculated to be 1·6 Mc/s, the theoretical being 1·67 Mc/s (the gyrofrequency). For double refraction, mean difference of 190 observations is 0·87 Mc/s, the theoretical being 0·93 Mc/s. Deviation from theoretical might be explained by a "hollowed-out" structure of the sporadic *E* layer. M. G. G.

MAGNETIC EFFECTS 538.6

538.615 : 541.182 : 535.347

Magnetic dichroism of colloidal solutions of ferric hydroxide. *See Abstr.* 174

MOLECULAR STRUCTURE 539.13

539.13 : 535.33

269. Formula for vibration frequencies of diatomic hydride molecules. LOVERA, G. *Nuovo Cim.*, **5**, 181–6 (*June*, 1948) *In Italian.*—The vibration frequency for a molecule of a diatomic hydride AH is calculated. It is assumed that the molecule AH consists of an atomic system A (with the electron of the H atom added) and a proton penetrating into the electronic structure of its partner, whose distribution law for the electronic density is represented by a function of hydrogen-like type with spherical symmetry. Then the following formula is deduced for the vibration wavenumber in the ground state:

$$\tilde{\nu} = 2\,546{\cdot}4\,\sqrt{[(v+1)(\alpha r_e)^{2n+1}\varepsilon^{-\alpha r_e}/(2n)!r_e^3\mu]}\,(\mathrm{cm}^{-1})$$

(r_e = internuclear distance of the molecule in its equilibrium state; μ = reduced mass; v = number of valency electrons for the atom A, with total quantum number n). The new formula fits the experimental data satisfactorily. A

539.13 : 535.375.5

270. On the vibration modes of the mono-substituted benzene derivatives. BARRIOL, J., AND CHERRIER, C. *J. Phys. Radium* (*Sér.* 8) **9**, 130–3 (*April*, 1948) *In French.*

539.132 : 541.51

271. Electron affinity of the oxygen molecule. KAZARNOVSKI, I. A. *Dokl. Akad. Nauk SSSR*, **59** (*No.* 1) 67–70 (1948) *In Russian.*—The electron affinity of the O_2 molecule has been calculated on the basis of new data regarding the higher oxide of K of structure $K^+O_2^-$ with a O_2^- ion. A previous paper dealt with the preliminary value E_0 calculated from the lattice energy. A more comprehensive treatment of lattice energies of KO_2, RbO_2 and CsO_2 is given. The mean value obtained is $E_0 = 22 \pm 1{\cdot}5$ kcal. The max. error cannot possibly exceed 10 kcal, so the most probable value is 22 ± 10 kcal. F. L.

539.133 : 541.115

272. The calculation of resonance energies from thermal data. BREMNER, J. G. M., AND THOMAS, G. D.

Trans. Faraday Soc., **44**, 338–41 (*May*, 1948):—The Pauling and Kistiakowsky methods give different values for the resonance energies of aromatic compounds. This difference is ascribed to the approximate nature of the Pauling bond energies. An alternative "group" rather than bond method, is suggested for referring the aromatic to the aliphatic series. This alternative method gives resonance energies in good agreement with the Kistiakowsky values. A.

ATOMIC STRUCTURE ISOTOPES 539.15

539.152.1

273. Erratum: Electromagnetic properties of nuclei in the meson theory. MA, S. T., AND YU, F. C. *Phys. Rev.*, **74**, 500 (*Aug.* 15, 1948).—See Abstr. 3090 (1942).

539.152.1 : 537.591.1

Cosmic rays and the nuclear structure of atoms. *See Abstr.* 252

539.152.1 : 539.185.7

274. Nuclear level spacing deduced from the resonance absorption of neutrons. CHAO, C. Y. *Sci. Rep. Nat. Tsing Hua Univ.*, **4** (*Nos* 4–6) 257–67 (1947) *In English.*—From the β-activity induced by the photo-neutrons scattered in a thin paraffin layer, the average spacings of the resonance levels of Ag-, Rh- and Br-nuclei for neutron energies between 0 and $1{\cdot}4\times10^5$eV are estimated. As an improvement on the previous calculation, the present one takes into account the variation of the neutron width of the levels with the resonance energy and recent data are used. Level spacings are also estimated from the β-activity induced by the primary photo-neutrons. The results obtained by the two methods are found in good agreement. For both Rh^{44} and Ag^{22} the level spacing is found to be about 8 V, and for Br^{18} it is about 30 V. The general agreement of the results by the two methods may be regarded as an indirect proof of the correctness of the assumed variation of the level width with the energy. A.

539.155.2 : 535.24 : 541.23

275. The isotopic compositions and the atomic weights of neodymium, samarium and tungsten. MATTAUCH, J., AND SCHELD, H. *Z. Naturforsch.*, **3a**, 105–14 (*Feb.*, 1948) *In German.*—The abundance ratios of the isotopes of Nd, Sm, W were measured by the photometric method [Abstr. 1624 (1948)], with Zn and Xe as calibration elements, using both singly and doubly charged ions. The results are tabulated. H. L.

539.155.2 : 536.48

276. Concentration of He^3 by evaporation of liquid helium at temperatures below the λ-point. ROLLIN, B. V., AND HATTON, J. Letter in *Phys. Rev.*, **74**, 508 (*Aug.* 15, 1948).—Evaporation of He containing 0·15% He^3 in the He II region under conditions at which the fractionating effect of the film flow is greatly reduced gave a 10-fold enrichment of He^3 in the vapour phase, as opposed to the results of experiments by Fairbank *et al.*, carried out at lower He^3 concentrations [Abstr. 2535 (1948)]. It is possible that the discrepancy is due to a fundamental difference between the properties of concentrated and dilute solutions [Abstr. 2449 (1948)]. However, it seems possible to the authors that the results of Fairbank *et al.* may have been obscured by a predominance of the film effect. H. L.

539.155.2 : 541.133.1

277. On the enrichment of isotopes by electrolytic transfer in aqueous solutions. KLEMM, A. *Z. Naturforsch*, **3a**, 127–8 (*Feb.*, 1948) *In German.*—A formula is derived giving the dependence of the transfer velocity ratio of isotopic ions on (1) the difference in ionic mobility of equally hydrated ions, (2) the difference in hydration, (3) the difference of dissociation. [See Abstr. 1932–4 (1947)]. H. L.

539.155.2 : 541.135.2

278. Concentration of copper 63 by the counter-current electromigration method. MADORSKY, S. L., AND STRAUS, S. *J. Res. Nat. Bur. Stand., Wash.*, **41**, 41–4 (*July*, 1948).—Concentration of Cu^{63} by the counter-current electromigration method is described. The electromigration cell was operated with $CuSO_4$ as the electrolyte for periods of about 400 to 500 hr. A definite, though small, concentration of Cu^{63} in the cathode compartment of the cell was obtained. The terminal separation coefficient was about $\frac{1}{3}$ of that found for Cl under similar conditions. A.

RADIOACTIVITY . α-, β- AND γ-RAYS 539.16

539.16.08

279. On cloud-chamber valves. CHU, F.-H., AND VALLEY, G. E. *Rev. Sci. Instrum.*, **19**, 496–9 (*Aug.*, 1948).—An investigation of the factors which influence the opening time of Fussell-type cloud-chamber valves has been made. In particular, the action of auxiliary triggering coils has been examined. The feasibility of constructing such a valve which is held shut by a permanent magnet is demonstrated. It is shown that valves can be easily made, whose opening time is limited not by electrical but by mechanical parameters. A.

539.16.08

280. A study on a contaminated cloud chamber. SITTE, K. *Čas. Pest. Mat. Fys.*, **73** (*No.* 1) 31–40 (1948) *In English.*—Experiments on a cloud chamber contaminated with radioactive substances, probably since Lord Rutherford's time, were made. At first the influence of the electric cleaning field used for the removal of ionization products from the chamber on the number of α-particles and ions was investigated. It was established that the presence of an appreciable number of α's initiates a decline in the visibility of electron tracks. The possible causes of this phenomenon were investigated theoretically and experimentally. The probable explanation may be found in the condensation heat of the vapour given off along the α-tracks causing an adiabatic pressure rise in the chamber beyond the value at which track formation is still possible. A.

539.16.08 : 535.89

A cloud chamber illumination system. *See Abstr.* 202

539.163.2

281. The disintegration of Cs^{137}. TOWNSEND, J., CLELAND, M., AND HUGHES, A. L. Letter in *Phys. Rev.*, **74**, 499 (*Aug.* 15, 1948).—Cs^{137} (33 yr) has a simple β-spectrum and one γ-ray of energy 0·663 MeV, 12% converted [see Abstr. 3891 (1948)]. However, coincidence counting experiments revealed no β–γ coincidences and yet critical absorption coincidence experiments between the conversion electrons and the associated X-rays showed the X-rays to be characteristic of Ba, and therefore the γ-rays to be emitted by the excited Ba^{137} nucleus which follows the Cs^{137} β-decay. A Ba separation showed that in fact the Ba^{137} excited state had a $\frac{1}{2}$-life of 158 ± 5 sec, indicating that large spin changes are involved in the γ transition, as well as in the β transition. R. W. P.

539.163.2

282. Shape of the positron spectrum of N^{13}. COOK, C. S., LANGER, L. M., PRICE, H. C., JR., AND SAMPSON, M. B. Letter in *Phys. Rev.*, **74**, 502–3 (*Aug.* 15, 1948).—Investigations were carried out with a β-ray spectrometer (counter window transmitting electrons to 2·0 keV) of the positrons from an N^{13} source. The experimental data fit a Fermi plot for $W > 1{\cdot}3\ mc^2$. This energy is < for either Cu^{61} or Cu^{64} [Abstr. 1903, 3894 (1948)]. Thus the deviations from the Fermi theory in these 3 allowed transitions seem to depend both on the nuclear charge Z and the maximum energy W. The end point energy is $1{\cdot}25 \pm 0{\cdot}03$ MeV for the N^{13} positrons [Abstr. 1358 (1946)]. R. W. P.

539.165.2

283. Variation with time of β-decay and its experimental confirmation. HOUTERMANS, F. G., AND JORDAN, P. *Nachr. Wiss. Göttingen* (*No.* 1) 45–7 (1945) *In German.*—The decay const. of β-radiation and K-capture decreases with time (t) from the formation of the world as $t^{-\frac{1}{2}}$. The accuracy of this law is discussed in connection with possible discrepancy between the decay const. of the K-capture of the K^{40} isotope and the quantity of A^{40} present, the determination of the age of the world by the Sr method, and the change in the branching ratio of the C-products of the radioactive disintegration series and the corresponding intensity ratios of the pleochroic haloes of the Th series. B. A.

539.165.2

284. On the influence of ionization on the time of capture of electrons. BENOIST, P. *C.R. Acad. Sci., Paris*, **226**, 243–5 (*Jan.* 19, 1948) *In French.*—Conditions are discussed where this effect may be measurable. For s-electrons captured by the nucleus it increases very rapidly with the degree of ionization, and it is sensitive to the energy balance. It becomes very large when the energy balance is small, but it is then difficult to measure as the lifetime becomes very long. Estimates of the times are given. G. J. K.

539.165.2

285. Proof of the variation of the period of Be^7 as a function of the degree of ionization of the atom. BOUCHEZ, R., DAUDEL, P., DAUDEL, R., AND MUXART, R. *C.R. Acad. Sci., Paris*, **227**, 525–7 (*Sept.* 6, 1948) *In French.*—Equal amounts of Be^7 in the forms of element and fluoride respectively were placed in identical ionization chambers, and the differential ionization current as a function of time was recorded over a period of ~4 weeks. The period of decay by orbital electron capture was found ~1% shorter for the metal than for the ionized state, which agrees with the difference expected theoretically. A. P. F.

539.165.2 : 537.533.7

286. Magnetic spectrograph of caustic type for particles of the electrino type. THIBAUD, J. *C.R. Acad. Sci., Paris*, **225**, 1302–4 (*Dec.* 22, 1947) *In French.*—Further consideration of the families of periodic trajectories of light particles moving in a radially symmetrical magnetic field [Abstr. 1640 (1948)]. The particles are assumed to have magnetic moment μ and charge e', the latter being so small that even at velocities near c the force $\mu\partial H/\partial\tau$ is comparable with the force $He'v$. The paths of both +ve and −ve particles whose magnetic moments are oriented respectively || and anti-|| to the field are examined. The effects of variation of particle energy and of source-position on the concentration of particle trajectories are demonstrated. J. H. F.

539.165.2 : 539.163.2

287. Beta–beta coincidence curves for Ir^{192} and Ta^{182}. SCHERB, M. V., AND MANDEVILLE, C. E. Letter in *Phys. Rev.*, **74**, 508–9 (*Aug.* 15, 1948).—The coincidence rate is shown as a function of the thickness of absorber placed before one counter. The curve for Ir shows a maximum [see Abstr. 1053 (1948)] which is absent if absorbers are placed before both counters. A. P. F.

539.165.8 : 539.167.3

288. (Contribution) to the question of the mechanism of the electrical method of separating nuclear isomers. KARAMYAN, A. S., AND RUSINOV, L. I. *Dokl. Akad. Nauk SSSR*, **58** (*No.* 4) 573–6 (1947) *In Russian.*—Having shown in a previous paper [Abstr. 2639 (1947)] that EtBr activated by slow neutrons and subjected to electrolysis gives rise to separation of nuclear isomers, an attempt has been made to explain the mechanism of that effect. Experiments have shown that β-activity decaying with $\frac{1}{2}$-life period of 18 min is dependent on the separation of nuclear isomers of Br. The mechanism of separation may be explained as due to the disturbance of the radioactive equilibrium of the decaying isomeric nuclei Br^{80*} and Br^{80}. Contrary to Capron and co-workers [Abstr. 2150 (1946)], the separation occurs even without the use of an electric field. The separation of isomers cannot be explained by the Br^{80*} and Br^{80} ions having different mobilities in the electric field. It has been shown that the disturbance of the radioactive equilibrium takes place in the EtBr itself, and that the separation of nuclear isomers in the case under examination is not determined by the method of isolating the radioactive substance. It is suggested that, having captured thermal neutrons, practically all radioactive Br atoms fly off the EtBr molecules as a result of the large recoil energy. In the next stage, some of the radioactive atoms remain in the free state while other atoms, including the Br^{80*} isomers, are again synthesized to form organic molecules and again fly off the molecules as soon as Br^{80*} is transformed into Br^{80} F. L.

539.166.74/.75

289. Concerning the resonance absorption and scattering of the γ-radiation. BARIT, I. J., AND PODGORETZKY, M. I. *C.R. Acad. Sci. URSS*, **54** (*No.* 7) 587–9 (1946) *In English.*—Resonance absorption of a photon by a nucleus is possible only when the energy of the photon is greater than the excitation energy. A formula relating the latter to the energy of the photon is given and also a formula for the absorption probability. Experimental results of Oppenheimer [Abstr. 3586 (1936)] and Zuber [Abstr. 1157 (1944)] are interpreted. L. S. G.

539.166.75 : 539.152.1

290. A possible method of investigating the selective absorption of γ-rays by atomic nuclei. BARIT, I., GROSHEV, L., AND PODGORETSKY, M. *Dokl. Akad. Nauk SSSR*, **58** (*No.* 6) 1011–12 (1947) *In Russian.*—The possibility is demonstrated of observing selective absorption of γ-radiation by atomic nuclei by the method of "self-indication," a method analogous to that used in neutron physics. At the same time Γ_2, the width of the line for resonance transition, can be measured. The radiation used has a continuous spectrum and a material is used which possesses metastable energy levels, e.g. gold. If the upper limit of radiation lies between the 1st and 2nd activated levels of the indicator, its activity will be determined only by the occurrence of selective absorption of the γ-rays on the 1st activated layer. Using such an indicator an absorption curve is taken in the same material from which the indicator is made. The slope of the curve is partly determined by the occurence of selective absorption in the filtering medium. The considerations connected with the influence of recoil impulses thus do not play any part. Practical possibilities of investigating the resonance absorption depend on the relation between its effective section and the section of all the non-resonance processes. W. H.

539.166.835 : 537.12

291. On electron pairs produced by gamma rays in the presence of electrons. BORSELLINO, A. *Rev. Univ. Nac. Tucuman*, **6**, 7–35 (*Dec.*, 1947) *In Italian.*—The differential cross-section is calculated by standard perturbation methods. Asymptotic expressions of the total cross-section are given for high and low energies of the incident quantum. L. P.

539.166.835 : 537.12 : 517.37

292. On the evaluation of an integral occurring in the theory of electron pair production. GHIZZETTI, A. *Rev. Univ. Nac. Tucuman*, **6**, 37–50 (*Dec.*, 1947) *In Italian.*

539.166.835 : 537.12/.13

293. Interaction of the electron and positron in pair production. SAKHAROV, A. D. *J. Exp. Theor. Phys.*, **18**, 631–5 (*July*, 1948) *In Russian.*—The influence of the interaction of the components on the differential probability of pair production is investigated. A.

NUCLEAR REACTIONS 539.17

539.172.1

294. Activities produced in magnesium by deuteron bombardment. BOTHE, W. *Nachr. Wiss. Göttingen* (*No.* 1) 51–2 (1945) *In German.*—If Mg is bombarded with deuterons of sufficient energy the following reactions take place: Mg^{25} (d, α) Na^{22} ($Q = +3{\cdot}3$ MeV), Mg^{26} (d, α) Na^{24} ($Q = +3{\cdot}0$ MeV), and Mg^{26} (d, p) Mg^{27} ($Q = +3{\cdot}9$ MeV). The effective cross-sections (σ) of these three reactions have been determined with respect to range and energy of the deuterons. For the third of the above reactions $\sigma >$ the geometrical cross-section of 6×10^{-25} cm². The curve for Mg^{27} shows a decrease of σ for high deuteron energies. This is because the second reaction above goes on concurrently, both reactions giving rise intermediately to the excited Al^{28} nucleus which gives Na^{24} or Mg^{27}. Na^{22} should theoretically break down with emission of positrons, or by *K*-capture of electrons. Experiment shows that at most the latter process is twice as frequent as the former. B. A.

539.172.3

295. Theory of the artificial disintegration of beryllium by γ-rays. JEN, C. K., AND HSIEH, Y. C. *Sci. Rep. Nat. Tsing Hua Univ.*, **4** (*Nos* 4–6) 278–85 (1947) *In English.*—A theoretical investigation upon the probability of disintegration of Be^9 nuclei by γ-rays. The "photo-neutron" inside the nucleus is assumed to be in a *p*-state and, when ejected from the nucleus, is taken to be in a continuous state of free motion. The binding energy between Be^8 and a neutron in the nucleus is assumed to be $\simeq 1{\cdot}5$ MeV and the width of the potential hollow is $\sim 1{\cdot}14\times10^{-13}$ cm. The total cross-section of disintegration has been found to be $\simeq 4\times10^{-28}$ cm² for γ-ray energies $\simeq$ 2–3 MeV, when assuming the nuclei oriented at random with respect to the incident γ-rays. The present result is only in partial agreement with one experimental result but is widely different from another. A.

ATOM AND MOLECULE BEAMS MESONS . NEUTRONS 539.18

539.18 : 530.145

296. On the disintegration of the meson. MARTY, C., AND PRENTKI, J. *J. Phys. Radium* (*Sér.* 8) **9**, 147–9 (*April*, 1948) *In French.*—The decay of a π-meson into two μ-mesons of spin $\frac{1}{2}\hbar$ is considered, when the π-meson is either pseudoscalar or vector. The process is analogous to β-decay of a nucleon. With reasonable values of the interaction constants, agreeing with the corresponding Fermi constant for β-decay, the mean life-time of the π-meson is $\sim 10^{-8}$–10^{-10} sec. There are some difficulties with the decay of the μ-meson. G. J. K.

539.18 : 537.122

297. On the range of the electrons in meson decay. STEINBERGER, J. Letter in *Phys. Rev.*, **74**, 500–1 (*Aug.* 15, 1948).—Meson decay electrons in the delay range 0·6–4·5 μsec from a polystyrene stopping layer were detected in a twofold counter telescope between the layers of which variable absorbers of polystyrene (CH_2) or carbon were inserted, and the range of decay electrons thus investigated. The range of most electrons was consistent with an

energy ~25 MeV but an appreciable number had considerably larger energies up to ~65 MeV. The decay electron spectrum thus appears to be complex. J. G. W.

539.18 : 537.591

Cloud chamber study of λ-mesons in air showers. *See Abstr.* 249

539.18 : 537.591

On the existence of particles with greater than mesotron mass. *See Abstr.* 250

539.181.08 : 533.73

298. A dynamic method for the determination of the velocity distribution of thermal atoms. KOFSKY, I. L., AND LEVINSTEIN, H. Letter in *Phys. Rev.*, **74**, 500 (*Aug.* 15, 1948).—It is reported that a rapidly performed and readily adaptable method for the determination of the velocity distribution of atoms evaporated from an oven, in which the atoms are pulsed by a single rotating sector disc, detected by a Langmuir–Taylor hot wire detector, and the rate of arrival of the atoms at the hot wire shown on an oscilloscope, has been investigated. Further improvements in the method are indicated. S. W.

539.185

299. On the Breit–Wigner formula. II. FLÜGGE, S. *Z. Naturforsch.*, **3a**, 97–104 (*Feb.*, 1948) *In German.*—The methods of an earlier paper on the one-level formula [Abstr. 3203 (1946)] are extended to the case of several levels. A detailed analysis for a narrow doublet, in which the resonance lines have equal height and breadth, shows that the resultant cross-section may exhibit a zero between two equal maxima, or may appear as a single sharp peak, or have some intermediate structure, according to the relative phases of the components. A. P. F.

539.185

300. The "thick-film chamber" method for the measurement of fast neutron flux. ALLEN, K. W., AND WILKINSON, D. H. *Proc. Camb. Phil. Soc.*, **44** (*Pt* 4) 581–7 (1948).—The theory of the method is considered and the design of the ionization chamber is described. Protons are detected in this chamber and the neutron flux is derived from their number and energy distribution. The sensitivity of the method is relatively high and the method is not affected by γ-rays. Measurements were made with neutrons derived from the D + D reaction. L. S. G.

539.185 : 539.152.1

301. The angular distribution of D–D neutrons scattered by deuterons. DARBY, J. F., AND SWAN, J. B. *Aust. J. Sci. Res. A*, **1**, 18–27 (*March*, 1948).—An investigation using a Wilson cloud chamber. The apparatus and experimental procedure, and the method of selecting and reducing the observations, is described. Comparison of the result with the calculations of Buckingham and Massey [Abstr. 2721 (1941)] indicate better agreement with the distribution to be expected assuming ordinary forces than with that assuming exchange forces. A.

539.185.7

302. Scattering of thermal neutrons by methane between 20° and 200°K. GIBERT, A. *Portugal. Phys.*, **2** (*Nos* 3–4) 243–52 (1947) *In French.*—The scattering cross-section σ was measured at 5 temps. The results suggested a fall of σ in the transition gas → liquid, no change at liquid → solid, and a rise between 77 and 20°K ascribed to a 2nd-order transition. A. P. I.

539.185.7 : 539.155.

303. Neutron absorption in samarium. DEMPSTER, A. J. Letter in *Phys. Rev.*, **74**, 505 (*Aug.* 15, 1948).—Mass spectrograms of Sm before and after intense neutron irradiation are shown, and give proof that the whole neutron absorption by Sm consists in conversion of mass 149 to 150. [See Abstr. 2255 (1947)]. A. P. I.

STRUCTURE OF SOLIDS 539.2

539.2 : 531.1

304. Free energy in the statistical theory of order-disorder transformation. WANG, J. S. *Sci. Rep. Nat. Tsing Hua Univ.*, **4** (*Nos* 4–6) 341–60 (1947) *In English.*—The expression for the free energy of Helmholtz in Bethe's theory of order-disorder transformation is obtained from an approximate expression for the log of the partition function. The approximate partition is evaluated by integrating a system of total differential equations based on the general theorems of statistical mechanics together with the assumption that the equilibrium values of the degree of order and the energy are given by Bethe's method. In the case of interaction only between nearest-neighbour atoms the integration of the system of differential equations is straightforward. When the interactions between more distant atoms are included, the integration of these differential equations is possible only when the influence of the distant atoms, as represented by suitable interaction energies, satisfy certain partial differential equations, which are solved with the help of boundary conditions based on physical requirements. The application to the problem of adsorption is treated first for the sake of simplicity. A.

539.211.08

305. Plastic replicas for surface-finish measurement. PEARSON, J., AND HOPKINS, M. R. *J. Iron Steel Inst.*, **159**, 67–70 (*May*, 1948).—A method of making replicas of metal surfaces, by polymerizing methyl methacrylate *in situ* by means of ultraviolet radiation, is described. The replicas are suitable for direct examination by surface-finish measuring instruments of the stylus type, and their use makes it possible to examine surfaces which are awkwardly situated or otherwise inaccessible. They can also be used for metallographic and other methods of examination. Fidelity of reproduction is discussed. M. R. H.

539.216.1 : 531.44

306. On the cause of the frictional difference of the wool fibre. MAKINSON, K. R. *Trans. Faraday Soc.*, **44**, 279–82 (*May*, 1948).—An analysis has been made of the ratchet theory of the frictional difference of the wool fibre, and the theory developed into a semi-quantitative form. The theory has been shown to be in agreement with a number of experimental observations, some of which are not explicable in terms of an asymmetrical molecular field at the surface of the fibre, and some of which were previously regarded as disproving the ratchet theory. It therefore appears

probable that the frictional difference is due to a ratchet effect. A.

539.217.08 : 539.163

307. A new method of measuring diffusion coefficient in solids with radioactive tracers. KUCZYNSKI, G. C. *J. Appl. Phys.*, **19**, 308–9 (*March*, 1948).—One face of a rectangular specimen a few cm in length is covered with a thin layer of radioactive material whose diffusion is to be measured and is then heated for a long period of time. Afterwards, the flat surface perpendicular to the activated face is etched electrolytically. The specimen is then transferred to a Pb box with its etched surface up. The sliding cover is moved so that edge A is at an arbitrary distance x_1 from the radioactive layer and a reading of the radioactivity I_1 is taken. Then the sliding cover is moved to the left so that edge B will take the position x_2 such that the radioactivity reading I_2 from this portion of the specimen is equal I_1. From these two readings only, the diffusion coefficient can be calculated. A.

539.234 : 539.27

308. Structure investigations of very thin metallic films. HAST, N. *Ark. Mat. Astr. Fys.*, **34 B** *Paper* 21 4 *pp.* (1947) *In Swedish.*—Electron-interference examination of Al films produced by evaporation on thin zaponlac skin showed that when the film thickness <50 Å the Al ring diagram becomes blurred and a new system of rings appears. At thickness 20 Å the Al diagram is no longer present. Similar diagrams obtain with Au and Be. The explanation is sought in diffusion of metal atoms into the skin. This is supported by conductivity measurements on metal films deposited on glass: for film thickness <40 Å, a slight conductivity appears during evaporation but resistance soon becomes ∞. The phenomenon is suggested as basis for a sonde method of investigating complex molecule structure in the skin. J. A. W.

ELASTICITY . STRENGTH . RHEOLOGY 539.3/.8

539.31 : 539.374

309. A variational principle of maximum plastic work in classical plasticity. HILL, R. *Quart. J. Mech. Appl. Math.*, **1**, 18–28 (*March*, 1948).—Classical equations for an ideal plastic material are reviewed and a variational principle of max. plastic work is derived. This principle is applied to the problem of a uniform bar of arbitrary section deformed in combined tension, torsion and bending. A.

539.311

310. A uniqueness theorem in the theory of highly-elastic materials. RIVLIN, R. S. *Proc. Camb. Phil. Soc.*, **44** (*Pt* 4) 595–7 (1948).—It is assumed that an incompressible, highly elastic material has a stored-energy function W given by $W = C_1(\lambda_1^2 + \lambda_2^2 + \lambda_3^2 - 3) + C_2(\lambda_1^{-2} + \lambda_2^{-2} + \lambda_3^{-2} - 3)$, where C_1 and C_2 are two positive constants and λ_1, λ_2 and λ_3 are the principal extension ratios. It is proved that if a cube of such material is deformed in a pure, homogeneous manner into a cuboid, under the action of surface forces, its equilibrium state of deformation is uniquely determined and is stable if the stresses are specified. A.

539.37 : 548.53 : 669.35.5

311. The deformation and recrystallization of an alloy containing two phases. HONEYCOMBE, R. W. K., AND BOAS, W. *Aust. J. Sci. Res. A*, **1**, 70–84 (*March*, 1948).—The deformation and recrystallization of a duplex brass containing 60% Cu and 40% Zn has been studied using microscopic and X-ray methods. In compression and tensile tests the α phase commences to deform plastically at a lower stress than the β phase, and even after heavy deformations, it is deformed more severely. Which of the two phases starts to recrystallize first on annealing depends on the rate of cooling of the alloy prior to deformation. In the quenched wires the α phase commences to recrystallize $\sim$100°C below the β phase, whereas in the slowly cooled wires the β phase commences to recrystallize before the α phase. In the former case, the β recrystallizes at a lower temperature, the smaller the amount of β present, i.e. the lower the temperature of quenching. It has been shown that the order-disorder transformation is responsible for the difference of behaviour of the slowly cooled wires from that of the quenched wires. Microscopic examination shows that the α phase starts to recrystallize at random, whereas the β phase tends to nucleate at the boundaries between the two phases. The experiments indicate that it is not possible to conclude that a phase has suffered more severe deformation because it commences to recrystallize at a lower temperature. A.

539.371/.374

312. The formation and enlargement of a circular hole in a thin plastic sheet. TAYLOR, G. I. *Quart. J. Mech. Appl. Math.*, **1**, 103–24 (*March*, 1948).—The hole is made by a conical-headed bullet or by outward radial pressure on its edge. The metal piles up into a thickened crater. The ratios of the principal stresses at each element of the sheet vary as the deformation proceeds. If a is the radius of the hole at any time, the strain is elastic at points where r, the radius, is $>3{\cdot}64a$. For $2{\cdot}21a < r < 3{\cdot}64a$ the strain is plastic, but comparable in magnitude with the small elastic strain when $r > 3{\cdot}64a$. There is finite strain where $a < r < 2{\cdot}21a$ and at the edge of the hole the sheet has thickened to 2·61 times the thickness of the sheet. Experiments were made with Pb. An unsymmetrical deformation was produced. This required less work than the symmetrical deformation described above, in the ratio 2·6 to 1·0. For related work see Abstr. 3690 (1947). L. S. G.

539.374 : 539.22 : 548

313. Some problems in the theory of plasticity of anisotropic media. MAKHOVER, E. V. *Dokl. Akad. Nauk SSSR*, **58** (*No.* 2) 209–12 (1948) *In Russian.*—An examination of plastic torsional and two-dimensional deformation to determine the necessary and sufficient conditions for the constants of the medium to obtain a given deformation with any contour of the cross-section, the condition of flow being based on Mises' hypothesis. It is found that plastic torsional deformation is only possible if the plastic constants of the medium satisfy the condition $a = b = c = d = 0$, which in the particular case corresponds to a crystal with regular anisotropy. Expressions are also given for hexagonal and monoclinically-anisotropic crystals. Applying the

transformation suggested by M. Levy to the two-dimensional case a system with limited coefficients is obtained which is integrable in the same manner as the equations of an isotropic medium. The conditions for the fulfilment of the Levy transformation are stated. L. J. G.

539.382/.384 : 539.4.25 : 531.224.8

Mohr's theory of failure. *See Abstr.* 65

539.4.011.22/.24 : 539.11 : 539.501

314. The mechanism of flow for solid metals. EYRING, H., FREDRICKSON, J. W., AND MCLACHLAN, D., JR. *Proc. Nat. Acad. Sci., Wash.*, **34**, 295–304 (*June*, 1948).—The solid state is treated as a continuum of varied density in which exist both regions of exact atomic order as well as actual holes. Imperfections are discussed under "equilibrium" and "non-equilibrium" headings, those created by fluctuations in density being handled by the use of the equation $(\Delta\rho/\rho)^2 = kT\beta/V$, together with an equation relating strain-rate to certain thermodynamic and structural (e.g. V_h the volume of a "hole") parameters. The experimental temperature-independence of $\Delta F^*/T$ is discussed. Using experimental data obtained with brass and steel, the value of V_h calculated is found to be unreasonably small, and an explanation is discussed on the basis of the compressibility of the positive kernels of atoms—i.e., without conductance electrons. It is deduced that the value of V_h is the most influential of the flow factors. (ΔF^* = free energy of activation). A. J. K.

539.501

315. Large plastic flow and the collapse of hollow cylinders. BRIDGMAN, P. W. *J. Appl. Phys.*, **19**, 302–5 (*March*, 1948).—The collapse of heavy steel cylinders under external pressures up to 412 000 lb/in² was studied. The distortions are so large that the conventional small strain analysis is not adequate. The presence of large strains is recognized by writing the stress equations of equilibrium in terms of the final displaced positions of the particles instead of the initial positions. Negligible volume change is assumed. In the experiments the cylinders showed no change of length. The generality of the conditions under which this may be expected is examined. A linear relation was found experimentally between collapsing pressure and $\log(r_{ext}/r_{int})$. Furthermore, $P/\log(r_{ext}/r_{int})$ is not constant but rises continually with increasing collapsing pressure. These results indicate that the strain hardening increases continually with increasing distortion, but at a rate two- or threefold less than would be given by experiments in simple tension. The collapse was extended experimentally to such extremes that the geometrical symmetry was lost because of the grain structure, thus limiting the region of applicability of any simple theory. A.

539.893 : 539.41 : 541.7.034.2

316. General survey of certain results in the field of high pressure physics. BRIDGMAN, P. W. *J. Wash. Acad. Sci.*, **38**, 145–56 (*May* 15, 1948).—Nobel Laureate Lecture. Improvements in experimental technique are described. Compressibilities and polymorphic transitions of some thirty elements and simple compounds have been studied with pressures up to 100 000 kg/cm². Polymorphic changes are quite common. Melting curves up to 40 000 kg/cm² have shown no signs of any critical pressure. Yellow phosphorus and carbon disulphide are permanently changed by high pressure at 200°C. Electrical resistance of metals may either increase or decrease with pressure and semi-conductors may become good conductors. A few thermal conductivity measurements have shown no change in the Wiedemann–Franz ratio with high pressure. The effects of pressure on the thermo-electric effects are sometimes complicated. Viscosity rises with increasing pressure, the extent of the rise depending on the complexity of the molecule. T. S. E. T.

PHYSICAL CHEMISTRY 541

PHASE EQUILIBRIUM 541.121/.123

541.123.3 : 542.48

317. The design of azeotropic distillation columns. HODGSON, M. A. E. *Research, Lond.*, **1**, 568–75 (*Sept.*, 1948).—From a consideration of ternary liquid/vapour equilibria, the processes of azeotropic distillation, extractive distillation and liquid extraction are shown to be closely related. A method of investigating and representing such systems is presented which frequently leads to the application of simplified graphical methods for designing azeotropic distillation columns and requires a minimum of experimental data. A.

REACTION KINETICS 541.124/.128

541.126

318. The detonation process in gases. DÖRING, W. *Ann. Phys., Lpz.* (*Folge* 5) **43** (*Nos* 6–7) 421–36 (1943) *In German.*—A model detonation wave, consisting of a surge initiating the reaction behind it by increased temperature and pressure, is assumed and a theory of detonation is developed. A state corresponding to the points on the Hugoniot curve below the point of minimum normal detonation velocity cannot exist behind a plane stationary detonation wave. After a certain period the velocity of propagation becomes equal to the normal detonation velocity, however small the speed of reaction. Initial larger velocities give rise to rarefaction waves, and subnormal velocities to compression waves. The effect of bounding walls may be to slow down the velocity to that of sound, depending on pipe dia., reaction and detonation speed. Pulsations and spin may also result, the latter ∝ pipe dia. V. W. R.

ELECTROCHEMISTRY 541.13

541.13.082

319. A cathode ray polarograph. RANDLES, J. E. B.

Trans. Faraday Soc., **44**, 322–7 (*May*, 1948).—The electrical circuit design and mode of operation of an instrument termed a cathode ray polarograph are described. The function of the instrument is to trace on the screen of a cathode ray tube a current-voltage curve for a dropping Hg electrode immersed in a solution containing small amounts of electro-reducible or -oxidizable substances. The current-voltage curve shows current peaks, each peak corresponding to an electro-reduction or -oxidation, and the height of a peak is accurately proportional to the concentration of the electro-reducible or -oxidizable substance. A.

541.13.082

320. A cathode ray polarograph. II. The current-voltage curves. RANDLES, J. E. B. *Trans. Faraday Soc.*, **44**, 327–38 (*May*, 1948).—The diffusion current-voltage curve obtained by means of the c.r. polarograph [Abstr. 319 (1949)] shows a sharp maximum of the current corresponding to the onset of each individual electro-reduction or -oxidation. The theory of the diffusion process under these conditions is discussed, and a graphical solution of the diffusion equation is obtained for the case that the electrode reaction occurs reversibly, and that the reactants and products are soluble either in the aqueous medium or the electrode material (which may be mercury). Good agreement between theoretical and experimental curves is obtained. Photographs of experimental cathode ray traces show the effect on the current-voltage curves of slowness of the electrode reaction (irreversible electrode process), of variation in the rate of change of potential of the electrode, and of phenomena similar to polarographic maxima. Experimental data are presented which indicate a strict proportionality between the concentration of a substance which reacts at the electrode, and the value of the corresponding diffusion current at its maximum. The cathode ray polarograph may therefore be used for analytical purposes. A.

541.133

321. On the theory of conductivity of strong electrolytes. KHALATNIKOV, T. *J. Exp. Theor. Phys.*, **18**, 187–200 (*Feb.*, 1948) *In Russian.*—The following non-stationary problem is considered. On a binary-electrolyte in which the mobilities of the two types of ions at the time $t = 0$ are equal, an external electric field X is impressed. The conductivity of the electrolyte is then found as a function of time and the intensity of the constant electric field. A.

541.133 : 537.312 : 534.321.9

322. On the influence of rapid changes of temperature and pressure on the resistance of electrolytes. LICHTER, Y. I., AND KHAIKIN, S. E. *J. Exp. Theor. Phys.*, **18**, 651–8 (*July*, 1948) *In Russian.*—An investigation of very small changes of resistance of an electrolyte (an aqueous solution of $AgNO_3$) produced by oscillations of pressure and temperature accompanying the propagation of ultrasonic waves in the liquid. The method is based on the observation of the peculiar detector effect in the electrolyte when another electrical voltage of the same frequency as the ultrasonic frequency, but of a variable and controlled phase, is fed to the electrodes. The temperature and piezo-electric resistance coefficients of the electrolyte were observed, and it was found that the temperature coefficient of the resistance at an ultrasonic frequency of 285 kc/s remains at the same value as at steady temperatures (i.e. $\beta = 2{\cdot}16 \times 10^{-2}$ deg.$^{-1}$ at 20°c), meaning that there is no dispersion for that quantity. This enabled the piezo-electric coefficient of electrolytic resistance to be determined, which was found to be $\gamma = 107 \times 10^{-6}$ atm^{-1} (first determination of this constant). A.

541.133.1 : 537.363

323. A preparative electrophoresis apparatus. BUTLER, J. A. V., AND STEPHEN, J. M. L. *Research, Lond.*, **1**, 525–7 (*Aug.*, 1948).—An apparatus is described which permits the complete separation of amino-acids, peptides and proteins when their ionic mobilities differ sufficiently. It consists essentially of a long tube packed with porous materials, such as asbestos, glass or cotton wool. The tube is attached to closed Ag/AgCl electrodes so that electro-endosmotic flow does not occur during the passage of the current. Successful separations of all three classes of substances have been made. A.

541.133.1 : 539.155.2

Enrichment of isotopes by electrolytic transfer. *See Abstr.* 277

541.135.2 : 539.155.2

Concentration of copper 63 by the counter-current electromigration method. *See Abstr.* 278

541.139

324. Magnetochemical systematics. PACAULT, A. *Rev. Sci., Paris*, **86**, 38–61 (*Jan.* 1, 1948) *In French.*—The systematics of Pascal are reviewed for organic compounds and for inorganic compounds. The systematization of link values is discussed. Gray and Cruickshank's systematics are adversely criticized. W. R. A.

PHOTOCHEMISTRY 541.14

541.14

325. The mercury photosensitized reaction of dimethyl ether. MARCUS, R. A., DARWENT, B. DEB., AND STEACIE, E. W. R. *J. Chem. Phys.*, **16**, 987–93 (*Oct.*, 1948).—The Hg photosensitized reaction of dimethyl ether has been investigated at pressures between 28 and 500 mm and at temperatures between 25°c and 292°c. At 25°c the products consist almost entirely of H and 1,2-dimethoxyethane, and the initial step has been shown to be the abstraction of a H atom. At higher temperatures CH_2O, CH_4, C_2H_6 and probably $CH_3OC_2H_5$ become important products. CO is produced in the later stages from the decomposition of H . CHO. By varying the light intensity and pressure it has been shown that C_2H_6 and dimethoxyethane are produced by second order recombination of CH_3 and methoxy-methyl radicals respectively. The activation energies of the following reactions have been estimated:

$$CH_3 + CH_3OCH_3 \rightarrow CH_4 + CH_3OCH_2 \qquad E = 9{\cdot}0 \text{ kcal.}$$

$$CH_3OCH_2 \rightarrow CH_3 + CH_2O \qquad E = 19 \text{ kcal.}$$

the only assumption being that CH_3 and methoxy

methyl radicals recombine with zero activation energy. A.

ADSORPTION 541.183

541.183.02

326. Physical adsorption on non-uniform surfaces. HALSEY, G. *J. Chem. Phys.*, **16**, 931–7 (*Oct.*, 1948).—Analysis of adsorption on a uniform surface using the quasi-chemical theory of interaction shows that the hypotheses of the BET theory lead to substantially no adsorption beyond the first layer if $E_2 = E_L$, and stepwise isotherms if $E_1 > E_2 > E_3 > \ldots > E_L$. For the 1-layer adsorption of gases on Ag, Pt, and steel, the heterogeneous nature of the adsorbing surface is clearly indicated. Co-operative adsorption on the non-uniform surface is treated, and the co-operative analogue of the Freundlich equation derived. The typical multi-layer isotherm is shown to be composed of 3 regions: non-co-operative adsorption on a strongly heterogeneous surface; co-operative adsorption on a still heterogeneous surface; and co-operative multi-layer adsorption induced by small van der Waals perturbations some distance from the surface. The isotherm $p/p_0 = \exp\{-a/\theta^r\}$ is derived and shown to be a good representation of adsorption data that conform to the BET Type I, II, or III shapes. A.

CHEMICAL STRUCTURE 541.4/.6

541.5/.6

327. Unsolved problems of structural chemistry. PAULING, L. *Chem. Engng News*, **25**, 2970–3, 3045 (1947).—The following themes are briefly discussed: (*a*) The structures of O_3 and B_2H_6. O_3 may have the structure of an O_2 molecule loosely bound to an O atom or of a central O bound to two others with a bond angle of 125°, corresponding to a double and a single bond in resonance. B_2H_6 may have a structure analogous to that of C_2H_6 or two H atoms may be shared by the two B atoms; electron-diffraction examination of $B_2H_2Me_4$ supports the latter idea. (*b*) The non-existence of $HBrO_4$. (*c*) The structure of the uninegative Re^- ion. (*d*) The observed increase in the co-ordinated no. of atoms which do not possess sufficient electrons to permit formation of electron-pair bonds in no. permitted by the available bond orbitals, e.g. in B_2H_6, CaB_6, B_4C, Pt_4Me_{16}. (*e*) The extent to which covalent bonds occur in non-metallic compounds, e.g. Hg_2Cl_2, $K_2W_2Cl_2$, MeO_2, WO_2, and $Fe_2(CO)_9$, the observed diamagnetism of which is explained by the formation of a covalent bond between the two Fe atoms. (*f*) The production of colour in inorg. compounds by (i) close approach of metal atoms, e.g. the colour of some Fe compounds, can be correlated with the Fe–Fe distance, and (ii) the presence in the compound of an element with > 1 valency (many examples are given). (*g*) The existence of some stable polynuclear inorg. complexes, e.g. ordinary phosphomolybdic acid, $Mo_6Cl_8^{4+}$, Ta_6Br_{14}, and Pb_9^{4-} in liquid NH_3. (*h*) The structure of metals, intermetallic compounds, activated complexes, and some living materials. B. A.

541.57 : 535.338.4

328. Spectroscopic determination of binding moments. KEMPTER, H., AND MECKE, R. *Z. Naturforsch.*, **2a**, 549–56 (*Oct.*, 1947) *In German.*—From absorption spectra measurements on C_6H_6, $C_6H_5 \cdot CH_3$, C_6H_5OH, and p-$C_6H_4Br_2$ the moment of the C_{ar}–H link is $0{\cdot}24\times10^{-18}$D. The C_{al}–H moment is 0·68 in $C_6H_5CH_3$, 0·52 in $CHCl_3$ and $0{\cdot}30\times10^{-18}$D in trichloroethylene. The moment for the C–Cl link is $1{\cdot}33\times10^{-18}$. The value of the moment as a function of bond length is well described by a Morse function $\mu_0 e^{-a(r-r_0)}$. W. R. A.

541.57 : 536.422

329. Carbon-hydrogen bond strengths in methane. VOGE, H. H. *J. Chem. Phys.*, **16**, 984–6 (*Oct.*, 1948).—Earlier formulae for the electron-pair bonding energies of CH_4, and radicals derivable from CH_4, are combined with recent data on the energy levels of the C atom, the heat of sublimation of C, the energy for removal of the first H, and the dissociation energy of CH to obtain the energies of CH_3 and CH_2. A consistent set of values is found which is in agreement with a heat of sublimation of C of 120–140 kcal. and gives for the energies of successive removals of H atoms from CH_4 101, 90, 80, and 80 kcal., respectively. A.

541.57 : 541.27 : 539.153.4

330. Method of spin states. DAUDEL, R., AND JACQUES, R. *C.R. Acad. Sci., Paris*, **226**, 1451–3 (*May* 3, 1948) *In French.*—The bond number is defined by the method of spin states, and therefrom expressions are derived corresponding to the cases of free valency and degree of unsaturation. H. H. HO.

541.57 : 542.92

331. The energy of the C–H bond in the three picolines (methyl pyridines). ROBERTS, J. S., AND SZWARC, M. *J. Chem. Phys.*, **16**, 981–3 (*Oct.*, 1948).—The pyrolysis of the three picolines was investigated and the rates of the decomposition were compared with the rate of the decomposition of toluene. It was found that the process of the decomposition of the picolines is analogous to that of toluene, i.e. the rate determining step is the splitting of the picoline molecule into H atom and a picolyl radical. Comparison of the decomposition rates of the picolines and of toluene made it possible to calculate the C–H bond energy for these compounds. These were estimated at 75·5 kcal/mole for α-pic., 76·5 kcal/mole for β-pic., and 77·5 kcal/mole for γ-pic. It was concluded therefore that the resonance energy of the picolyl radical $\simeq$ the resonance energy of the benzyl radical. A.

541.62 : 539.133 : 535.343.32/.34

332. The energy mechanisms of aminobenzoic acids. SCHÜLER, H., AND WOELDIKE, A. *Z. Naturforsch.*, **2a**, 657–61 (*Nov.–Dec.*, 1947) *In German.*—The energy states of *o*-, *m*- and *p*-aminobenzoic acids in emission and in absorption in the vapour phase and in EtOH solution have been discussed. W. R. A.

541.636

333. Steric effects. II. General equations. Application to *cis*- and *trans*-2-butene. HILL, T. L. *J. Chem. Phys.*, **16**, 938–49 (*Oct.*, 1948).—Steric energy and the semi-empirical method of calculating steric energy

are discussed in the language of potential surfaces. Equations are given relating ΔH_0^0 for several types of reactions commonly used to exhibit steric effects experimentally to the steric energy of the molecules involved in the reactions. The equations of Westheimer and Mayer for the calculation of the steric energy of a molecule are generalized in several respects. The difference in ΔH_0^0 (formation) between *cis*- and *trans*-2-butene is calculated as a steric effect. Because of various complications the application of the method in its present form to molecules such as H_2O, NH_3, PF_3, etc., is rather unsatisfactory. A.

541.651 : 535.33/.34

334. Inner molecular energy transport. SCHÜLER, H. *Z. Naturforsch.*, **2a**, 556–62 (*Oct.*, 1947) *In German.*—The emission spectra of organic substances in the glow discharge, and in particular of the mono-, di- and tri-derivatives of benzene, are sometimes very different from the absorption spectra of the same compounds which are due to the excitation of the benzene ring. These differences are now described, discussed and traced to substituent groups and their mode of linkage. The fluorescent behaviour of the same substances is found to be analogous. An explanation is suggested based on electronic energy drift within the molecule. H. H. HO.

541.66

335. Absolute evaluation of the Hückel resonance integral. HARTMANN, H. *Z. Naturforsch.*, **2a**, 586 (*Oct.*, 1947) *In German.*—In the theory of unsaturated and of aromatic hydrocarbons, the application of the 2nd Hückel approximation process affords the energy amounts involved as multiples of a resonance integral β. Hückel obtained 18–20 kcal./mol. as the most plausible value for β from a comparison of theory with empirical data on heats of combustion and hydrogenation. The author's previous value of $-1{\cdot}57eV$ for the ground state energy of ethylene is now shown on Hückel's theory to be: $\beta = 0{\cdot}785eV = 18{\cdot}1$ kcal/mole. H. H. HO.

CHEMICAL PROCESSES 542.9

542.9 : 535.338

Reaction mechanism involving the free radicals C_3, CCl and CBr. *See Abstr.* 162

542.95 : 530.145

336. The theory of addition and transformation reactions of aromatic systems. HARTMANN, H. *Z. Naturforsch.*, **3a**, 29–34 (*Jan.*, 1948) *In German.*—Results of the quantum mechanical theory applied to aromatic hydrocarbons are compared with experimental data from addition and transformation reactions of aromatic systems, viz.: (1) The hydrogenation of aromatic hydrocarbons; (2) the addition of maleic anhydride to aromatic hydrocarbons; (3) the redox potentials of quinones; (4) the anthrone-anthranol transformation. The theory appears suitable for the qualitative correlation of a large number of empirical phenomena. H. H. HO.

542.95 : 530.145

337. The theory of addition and substitution reactions of unsaturated hydrocarbons. SEEL, F. *Z. Naturforsch.*, **3a**, 35–46 (*Jan.*, 1948) *In German.*—Energy changes from initial to intermediate and then to final stages for the addition and substitution reactions of hydrocarbons are calculated by means of the quantum mechanical valency theory, and the results are interpreted qualitatively. It is found that important relationships exist between the constitution and reactivity of unsaturated hydrocarbons, and, in particular, the cause of their separation into olefines and aromatic compounds becomes clear. It appears that the mesomeric (resonance) effect directs the reactions of compounds with conjugated double bands to states possessing the greatest possible number of valency formulae. H. H. HO.

CHEMICAL ANALYSIS 543/545

545.37

338. Automatic potentiometric titration of iron and titanium with chromous ion. LINGANE, J. J. *Analyt. Chem.*, **20**, 797–801 (*Sept.*, 1948).

545.71/.721 : 538.222 : 621.317.49

339. Continuous determination of oxygen concentration based on the magnetic properties of gases. RICHARDSON, R. D. *Trans. Amer. Soc. Mech. Engrs*, **70**, 211–16 (*April*, 1948).—Almost every process dealing with heat and gas reaction can be improved by the knowledge or detection of oxygen at some point in the cycle. In consequence a new instrument named "Magno-therm" has been developed for the continuous analysis of industrial gases for oxygen concentration, which should prove to be of universal application. It operates by the change in paramagnetism of oxygen with temperature, and therefore its readings are not disturbed by any extraneous gases except some of the oxides of nitrogen. The theoretical basis for this analyser is discussed, and a description given of the operating characteristics whereby the electrical impulse is picked up directly and measured on a recording bridge, a response of about 3 mV for 1% O being obtained. The instrument contains no chemicals or mixing orifices and is free of moving mechanical parts. H. H. HO.

545.82 : 535.338.334

340. Wide range analysis for zinc using spectrographic line widths. EASTMOND, E. J., AND WILLIAMS, B. E. *J. Opt. Soc. Amer.*, **38**, 800–3 (*Sept.*, 1948).—Determination of zinc in biological ashes by use of line width as a concentration index. Synthetic standards and analytical samples, in the form of sulphates, are mixed with a K_2SO_4-graphite buffer containing Ba and Cd as internal controls. Samples are excited in a d.c. arc and spectra recorded with a Littrow quartz spectrograph. The contour of Zn 2 138 Å is recorded with a recording microphotometer and the width determined at the maximum density of the control lines Ba 2 255 Å or Cd 2 288 Å. A plot of the logarithm of this width *v.* logarithm of Zn concentration prepared from standard samples containing 0·004 to 10% Zn serves as an analytical curve. Results of ordinary density measurements have been compared with those from width measurements. The two methods show comparable reproducibility at the lower limit of the range. The width method is more precise at higher ranges and applicable even at concentrations where the line density method is

limited by self-reversal and low photographic plate contrast. Concentrations as high as 10% have been determined, indicating possible application of such a method to the estimation of major constituents in such biological ashes or inorganic powders. A.

545.824

341. Organic quantitative analysis using the Geiger counter X-ray spectrometer. CHRIST, C. L., BARNES, R. B., AND WILLIAMS, E. F. *Analyt. Chem.*, **20,** 789–95 (*Sept.*, 1948).—Complete details covering certain improvements to the spectrometer and in the methods used for analysis are given. In particular, a method for the determination of the crystalline content of sodium penicillin G samples, accurate to ±2·5%, is given. The X-ray results obtained on a series of experimental samples of sodium penicillin are compared with those obtained by ultraviolet and infrared methods. A.

545.827 : 541.6

342. Mass spectra of octanes. BLOOM, E. G. MOHLER, F. L., LENGEL, J. H., AND WISE, C. *J. Res. Nat. Bur. Stand.*, **41,** 129–33 (*Aug.*, 1948). Mass spectra of the 18 isomers of octane have be measured. The sensitivity at the maximum peaks each spectrum relative to *n*-butane is computed well as the total ionization relative to *n*-buta Tables and plots of relative intensities in the ma spectra are given, and some correlations with structu are found. All isomers with a tertiary butyl radi have similar spectra. The other isomers tend dissociate at carbon atoms with one or two si chains attached to them. This determines wheth the loss of two or three carbon groups in dissociati is probable. Loss of 4 carbon groups is probab whenever the molecule ion can break in half in single dissociation process.

CRYSTALLOGRAPHY 548

548.0 : 53 : 548.1

343. Physical properties of crystals and their symmetry. TOURNIER, M. *Elect. Commun.*, **24,** 478–525 (*Dec.*, 1947).—The possible existence of piezoelectricity, piezomagnetism and pyroelectricity and of elasticities and dielectric susceptances in directions other than that of the applied force or field can be predicted from the degree of symmetry of a crystal. The numbers of coefficients not equal to zero are deduced for each of the 32 crystal classes. P. O.

548.0 : 535.372 : 536.48

Ultra-violet luminescence of KCl and KBr monocrystals, under X-rays at low temperatures. *See Abstr.* 183

548.0 : 537.311.33

Electronic conductivity in ionic crystals. *See Abstr.* 228

548.19 : 548.73

344. An analytical discussion of the construction of pole figures. WOOD, J. K. *J. Appl. Phys.*, **19,** 784–91 (*Aug.*, 1948).—The construction of pole figures of crystal orientation data obtained by means of X-rays can be made quickly and accurately if the angular relationships between planes or "poles" are known and if all of the data from a diffraction pattern are used. A flexible set of equations is derived from which these relationships can be found starting with customary crystallographic information. Data for an hypothetical case of diffraction are computed to illustrate the method. Although the examples refer, for the most part, to cubic crystals, the method can be extended to cover other types. A.

548.23 : 531.741

345. The stereogoniometer. TAYLOR, A. *J. Sci. Instrum. Phys. Ind.*, **25,** 301–4 (*Sept.*, 1948).—A machine has been constructed for measuring the orientation of crystals in coarse-grained polycrystalline metals. By means of a link mechanism, the orientations are instantaneously transferred to a plotting table to give their correct positions on a stereographic projection. A.

548.24 : 539.4.0

346. Influence of mosaic structure on resistance mechanical twinning of nitre. GARBER, R. I., ZA VADNUĬ, C. Y., AND STARTSEV, V. I. *Dokl. Aka Nauk SSSR*, **58** (*No.* 4) 571–2 (1947) *In Russian.* With reference to two previous papers by Garb [*J. Exp. and Theor. Phys.*, **10** (*No.* 7) 828 (1940 Abstr. 2319 (1947)] a study has been made of t exceptionally great resistance offered to mechanic twinning by some monocrystals of nitre. The i creased resistance of twin crystals ("elastic twins can be explained as due to hindrances encountered the spreading twin on the boundaries of mosa blocks. F.

MOLECULAR AND X-RAY CRYSTALLOGRAPHY 548.7

548.73 : 621.365.4

347. High angle X-ray diffraction at elevated tem peratures. STEWARD, E. G. *J. Sci. Instrum. Phy Ind.*, **25,** 331–2 (*Sept.*, 1948).—By means of the electri furnace described here, the "back-reflection" metho of X-ray diffraction may be used at temperatures u to ~900°c for single crystals and polycrystallin specimens. Constructional and operational detai are given, and the attainment of higher temperatur discussed. Temperature, measured by a therm couple, may be maintained to within ±2°c.

548.735.4

348. A new "averaging" method for the location atomic positions from X-ray data. BOOTH, A. L *Trans. Faraday Soc.*, **44,** 282–5 (*May*, 1948).

548.735.4

349. On the relation between certain distributions a their corresponding Patterson distributions. WRINC D. *Phil. Mag.*, **39,** 692–6 (*Sept.*, 1948).—Two seri of finite distributions in one-dimensional space a discussed. The first is a homologous series such th the Patterson of any member is also a member of t series, the first member being its own Patterson. T second series is obtained by interchanging "atomic and reciprocal space. L. S.

GEOPHYSICS 55

550.384/.386 : 523.3 : 525.24

A possible influence of the moon on recurrent geomagnetic activity. *See Abstr.* 37

550.491.55 : 532.51

Convection of fluid in porous medium. *See Abstr.* 81

551.465

350. Theory of unstationary wind-current. JAW, J. *Sci. Rep. Nat. Tsing Hua Univ.*, **4** (*Nos* 4–6) 363–78 (1947) *In English.*—The problem of unstationary drift currents which was solved by Fjeldstad in the form of an integral equation, is solved here more simply and directly by means of the operational method. The numerical calculation shows that the deflecting angle of the surface current against the direction of the wind differs widely from the value 45, which was found theoretically by Ekman. Even when the ocean is regarded as infinitely deep and the wind strength as varying periodically, the limiting value at $t = \infty$ cannot approach Ekman's value of 45. The total angle of fluctuation in the case mentioned, corresponding to conditions in the trade wind region, is found to be 18° 46′, which may somewhat explain the difference between the observational data and the theoretical values of Ekman. A.

ATMOSPHERE . METEOROLOGY 551.5

551.508.11

351. Controlled-altitude free balloons. SPILHAUS, A. F., SCHNEIDER, C. S., AND MOORE, C. B. *J. Met.*, **5**, 130–7 (*Aug.*, 1948).—The results of an experimental programme to develop balloons with associated control devices, which will float at constant pressure in the atmosphere, are given. Newly developed plastic balloons and automatic ballast equipment are described. Examples of successful controlled-altitude flights are shown, together with a preliminary analysis of their trajectories. The constant-level balloon may provide data not obtainable from an ordinary pilot-balloon network. Future possibilities and plans for its use are indicated. A.

551.510.5 : 551.593.5

352. Method for optical investigation of the atmosphere under daylight conditions by means of a searchlight beam. MIRONOV, A. V., KHVOSTIKOV, I. A., AND SHALNIKOV, A. I. *C.R. Acad. Sci. URSS*, **54** (*No.* 6) 483–6 (1946) *In English.*—A method is suggested by means of which daylight investigations of the atmosphere may be carried out up to heights of 10–12 km. A searchlight beam, using ultraviolet rays of wavelength less than 0·29 μ, is employed, the daylight sky causing no interference at such wavelengths owing to the absorption of solar radiation by O_3. For examination of the reflected and scattered light a photo-electric counter is used. The circuit details of this are given and some measurements of the intensity of scattered light at various heights are briefly reported. L. S. G.

551.510.535

353. Development of knowledge of the structure of the ionosphere. KESSENIKH, V. I. *Izv. Akad. Nauk SSSR Ser. Fiz.*, **11** (*No.* 2) 155–63 (1947) *In Russian.*—A brief account of some of the most important contradictions and gaps in present knowledge of ionospheric structure, the latter becoming increasingly apparent in the light of current observations. The need is stressed for an extension of the range of observations and their co-ordination with optical data and direct probing of the ionosphere. A.

551.510.535

354. A note on a new ionospheric-meteorological correlation. MIHRAN, T. G. *Proc. Inst. Radio Engrs*, **36**, 1093–5 (*Sept.*, 1948).—Past investigations in the field of ionospheric-meteorological correlation are reviewed, with special emphasis on ionospheric characteristics correlating with barometric pressure. An attempt to verify past correlations involving pressure has been made with negative results. However, a new correlation is presented between the time-of-occurrence of the maximum F_2 critical frequency during a single day and the average daily barometric pressure. A.

551.510.535 : 537.564

355. Balance equations of the ionospheric charge carriers. SEELIGER, R. *Ann. Phys., Lpz.* (*Folge* 6) **2** (*Nos* 5–6) 287–91 (1948) *In German.*—A short discussion of the solution of the equations governing ionization decay processes in the ionosphere. Curves are given which indicate qualitatively the variation in the negative ion/electron concentration after the external ionizing radiation is cut off. W. J. G. B.

551.515.11

356. The atmospheric problem according to the theory of spontaneous perturbations. GIAO, A. *Portugal. Phys.*, **2** (*Nos* 3–4) 203–34 (1947) *In French.*—It was shown earlier that the fundamental theorems of spontaneous perturbations lead to a rational explanation of the principal phenomena of solar hydrodynamics. A system of three equations with partial derivatives of the first order (one vectorial and two scalar equations) when solved provides a general solution of the problem of movement of a fluid, when the direct hydrodynamic effect of external forces on the medium is known. This theory is here applied to the problem of atmospheric perturbations. A complete solution is obtained which can be applied mathematically for the forecasting of weather over periods $\leqslant$ 48 hours. R. S. R.

551.521 : 551.524 : 551.525

357. Calculation of solar radiation and the solar heat load on man. KLEIN, W. H. *J. Met.*, **5**, 119–29 (*Aug.*, 1948).—A method of computing the intensities of direct, diffuse, and total solar radiation received on a horizontal surface of the earth is developed by consideration of sky radiation, terrain reflection, and depletion by dry air, water vapour, dust and clouds in the atmosphere. The calculation is extended aloft, and a general equation is derived expressing the atmospheric transmission coefficient with cloudless sky at any altitude between 300 and 8 000 m as a linear function of solar zenith distance and log of elevation. The contribution of solar radiation to the

heat load on man is then evaluated and expressed as an equivalent increment of temperature. A.

551.543

358. Atmospheric pressure changes: the importance of deviations from the balanced (gradient) wind. PRIESTLEY, C. H. B. *Aust. J. Sci. Res. A*, **1**, 41–57 (*March*, 1948).

551.555.1 : 533.6.011.5

359. An analogy between the equatorial easterlies and supersonic gas flows. FREEMAN, J. C., JR. *J. Met.*, **5**, 138–46 (*Aug.*, 1948).—The almost complete mathematical analogy is established between incompressible flow of air under an inversion, and one- and two-dimensional flow of a compressible fluid at high speed. Some mathematical and graphical methods of determining 1-dimensional flows are discussed and demonstrated. Since the tropical easterlies are often a 1-dimensional current with an inversion, the techniques are theoretically applicable to them. The theory admits three types of disturbances oriented normal to the current: a rarefaction wave, a compression wave, and a jump. The mathematical theory is shown to conform with general practical and practised tropical forecasting methods and to agree with specific examples. A.

551.574 : 536.423.4/.45

Invisible condensation. *See Abstr.* 211

551.593.5 : 525.7

The origin of the night sky light. *See Abstr.* 38

551.593.6

360. Rainbow colours. BUCHWALD, E. *Ann. Phys. Lpz.* (*Folge* 5) **43** (*Nos* 6–7) 488–93 (1943) *In German.*—The spectral energy distribution for a given raindro radius and angle of elevation is found. To determin the physiological colour appearance, use is made c the international standard red, green and blue stimul and the proportional stimuli. The method is firs used for a rainbow of drop radius 500 μ; a narro rainbow with single spectrum from red to blue wit final transition to white results. A drop radius 50 gives a weak saturated red to blue, with pure inter mediate white, and back to white via purpl Secondary rainbows are coloured, the 1st yellow, th 2nd purple, violet, blue and blue-green, a 3rd orange red, purple, violet, blue and green, etc. The ca culated values agree with observations. Smaller dro radii lead to white or "fog" rainbows. V. W. E

551.594.6 : 621.396.11 : 538.566.

Magneto-ionic refraction in the sporadic *E* layer. *See Abstr.* 268

551.594.6 : 621.396.812.3 : 538.566.

Reasons for a change in the amplitude of a singl impulse reflected from the ionosphere. *See Abstr* 267

BIOLOGY 57/59

591.181

361. Some aspects of the production of electricity by *Electrophorus electricus*. CHAGAS, C. *An. Acad. Brasil. Cienc.*, **19** (*No.* 2) 113–42 (1947) *In French.*—An account is given of the history of the study of the electrical properties of *Electrophorus electricus* and the electric organs are described. The characteristics of their electrical discharge were studied by means of a c.r.o. with photographic recording, and the power and quantity of electricity determined for various discharges. Speeds of electric conduction (small discharge) were up to 1 600 m/sec. Histological evidence is presented which supports the view that the electric properties are due to variations in ionic permeability. The energy developed per single discharge $\simeq 10^{-3}$ cal, and is of the same order as the energy from chemical reactions accompanying the discharge. This chemical energy is calculated from experimental results. The results set out in this paper and their interpretation are in accordance with the work of Nachmansohn *et al.* E. E. C.

MEDICAL SCIENCE . HUMAN PHYSIOLOGY 61

612.84

362. The magnitude of the threshold of binocular depth-perception under conditions of a different contrast between the objects of observation and the background, as affected by the length of the observation. GASSOVSKY, L. N., AND NIKOLSKAYA, N. A. *C.R. Acad. Sci. URSS*, **54** (*No.* 6) 487–9 (1946) *In English.*—Experiments measuring the variation of the threshold wit contrast and length of observation are describe The variation is shown graphically for contrast varying from 15% to 95%. A reduction of the tim of observation from ∞ to 1 sec does not appreciabl alter the threshold; but a reduction to $< 0{\cdot}5$ sec i accompanied by a very rapid increase in the threshol L. S. G

612.8

363. Haidinger's brushes and their explanation as contribution to a physical theory of human sight CORDS, O. *Optik*, **2** (*Nos* 5–6) 423–33 (1947) *I German.*

612.8

364. Size, shape, and contrast in detection of target by daylight vision. II. Frequency of seeing and th quantum theory of cone vision. LAMAR, E. S., HECHT S., HENDLEY, C. D., AND SHLAER, S. *J. Opt. Soc Amer.*, **38**, 741–55 (*Sept.*, 1948).—Frequency-of-seein curves have been obtained for targets having variou image perimeters at background brightnesses o 2 950 and 17·5 ft-lamberts, respectively. A descriptio of the data has been obtained on the basis of th assumption that the absorption of a light quantum by a foveal cone is a random event which is subject to th laws of chance. On this basis the data indicate tha the detection of a target takes place across the image boundary; that in order to detect the target, at leas one of the cones along the boundary must absorb a least 4 quanta, and that this critical number of quanta is the same for each of the two background bright nesses investigated. At the higher brightnesses, thi critical number of quanta absorbed from the targe

is about equal to the random fluctuation to be expected in the number absorbed from the background during the critical time of one exposure. A.

612.84 : 535.61

365. The effect of spectral quality of light on visual performance and fatigue. SIMONSON, E., AND BROZEK, J. *J. Opt. Soc. Amer.*, **38**, 830–40 (*Oct.*, 1948).—The amount of dependable information on the effects of the spectral quality of illumination on work performance is negligible. It was the purpose of the present study to investigate this problem. The work test involved recognition of very fine details (letters) and was designed to reproduce the essential features of conveyor inspection. Output, results of a large array of tests of visual functions, subjective reactions (complaints), and subjective preferences were considered as criteria in judging the relative superiority or inferiority of the 3 illuminants compared (ordinary inside frosted lamps; "natural white" lamps with a white, slightly bluish coating; and Verd-A-Ray lamps having a greenish coating). The illumination intensity (5 ft-c, 100 ft-c, and 300 ft-c) on the work place was made identical for all three lamps. Statistically significant differences between the illuminants were established with reference to a number of criteria of performance and fatigue. The differences were, in general, in favour of the illuminant with greenish coating. The present study used commercially available illuminants. A.

612.843.3

366. Subjective violet colour seen in stroboscopic examination of white light. CARRIÈRE, Z. *J. Phys. Radium* (*Sér.* 8) **9**, 122–9 (*April*, 1948) *In French.*—When a white screen is illuminated intermittently by white light so that the light : dark time ratio is between 0·003 and 1, and the frequency of interruption is between about 18 and 51 per sec, it appears violet owing to the short wavelength end of the spectrum having a longer time of persistence of vision. The above frequency limits vary slightly with the time ratio. Similar results are obtained with a direct view of a virtual image of the sun. N. C.

612.843.31

367. Chromatic adaptation of the eye. BOUMA, P. J., AND KRUITHOF, A. A. *Philips Tech. Rev.*, **9** (*No.* 9) 257–66 (1947–48).—The colour sensations produced by coloured objects are not greatly affected by the colour of the general lighting by which they are seen, owing to an adaptation effect. This has been studied by using the more saturated Ostwald colour cards, and it has been found that a change from daylight to tungsten light produces only a small change in the appearance of the cards as judged by the average observer. Other illuminants have been studied, and the results are used to locate the three physiological primaries on the colour triangle. J. W. T. W.

612.843.32 : 536.3

368. Sensitivity of the eye to the infra-red limit. LAU, E., AND LEO, W. *Ann. Phys., Lpz.* (*Folge* 6) **2** (*Nos* 5–6) 242–55 (1948) *In German.*—The sensitivity of the eye to radiation of wavelengths beyond the red limit of the int. luminosity curve as far as 980 mμ has been studied by using an arc source and a series of infrared filters. The sensitivity at 980 mμ is $1{\cdot}4\times10^{-10}$ relative to that at 555 mμ. J. W. T. W.

612.843.6

369. The quanta explanation of vision and brightness impression for various times of observation and visual angles. BOUMAN, M. A., AND VAN DER VELDEN, H. A. *J. Opt. Soc. Amer.*, **38**, 231–6 (*March*, 1948).—[See Abstr. 1133 (1948)]. Experiments are described which determined the dependence of the average number of quanta necessary for a certain brightness impression, on the visual angle and time of observation, for several values of the subjective brightness. After the absorption of two quanta at time $t = 0$, all subsequent quanta absorbed within an area O up to time $t = T$ contribute to the brightness impression, which is determined by the total number of stimuli. If the area $d > O$, and $t > T$, the average number of quanta necessary for a constant brightness impression $\propto d^2t$. The connection with the laws of Talbot and Ricco is demonstrated.

612.843.611

370. Dazzling and uniformity of dazzling field. GARELLI, C. M. *Elettrotecnica*, **32**, 268–73 (1945) *In Italian.*—Experimental proof that dazzling produced by extended sources depends not only on the flux density on the pupil of the observer, but also on the angular distance from the vision axis of bright points superposed on the uniform field. G. R.

612.843.63

371. Visual acuity as measured with various orientations of a parallel-line test object. HIGGINS, G. C., AND STULTZ, K. *J. Opt. Soc. Amer.*, **38**, 756–8 (*Sept.*, 1948).—Visual acuity has been measured in terms of the reciprocal of the angle in minutes subtended by the individual lines in a parallel-line test object at the limit of perception of the lines. Both clear and opaque lines in this test object were of equal width. It was found that the limit of perception of the lines in such a test object depends upon the orientation of the lines. Visual acuity, measured with the lines passing diagonally through the visual field at an angle of 45° to the horizontal, is between 10 and 20% < that measured with the parallel lines passing vertically or horizontally through the visual field. A.

612.85

372. Influence of interaural phase relations upon the masking of speech by white noise. LICKLIDER, J. C. R. *J. Acoust. Soc. Amer.*, **20**, 150–9 (*March*, 1948).—Speech and noise sounds are conveyed to the ears of the test subject by means of telephone earpieces. If monaural intelligibility is taken as a standard of comparison it is found that the advantage of binaural presentation of the speech and the noise depends on the interaural phase relations. Intelligibility is highest with noise plus speech in one ear, noise minus speech (i.e. the noise wave plus the inverted speech wave) in the other. The results suggest that by reversing the connections to one of the earphones a small but significant improvement in reception through earphones under noisy conditions can be gained. A. B. W.

612.85

373. Audibility of sounds of high frequency. GAVREAU, V. *C.R. Acad. Sci., Paris*, **226**, 2053–4

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(*June* 21, 1948) *In French.*—The author has demonstrated that sounds at supersonic frequencies, e.g. 17–26 kc/s, are quite audible, provided they have sufficient intensity. By gradually increasing the intensity of the sound, one or several sudden changes in pitch are apparently heard; at each change the pitch drops suddenly by an octave, approximately. It is suggested that this apparent variation in the pitch of the sound is explained by the excitation of other fibres of the auditory nerve, corresponding to the resonators vibrating in a harmonic mode (not the fundamental) which provokes, however, a response in the auditory nerve identical with that given normally by this resonator vibrating at its fundamental frequency. The supersonic sounds can still be heard when the sound intensity is reduced by 18–40 db from a "painful" level of ~ 5W total acoustic power.

A. B. W.

612.85 : 534.773 : 621.395.623.66

374. Speech communication under conditions of deafness or loud noise. RADLEY, W. G.; ACKROYD, J. O. *J. Instn Elect. Engrs, Pt I*, **95**, 201–16 (*May*, 1948).—Deafness and loud noise have the same effect on the reception of speech through telephone receivers: they increase the min. distinguishable speech signal. When either condition becomes severe, satisfactory intelligibility is attained only if the speech is reproduced very loudly, and at times with intensities approaching those which give rise to a sensation of pain. The range of hearing loss for which hearing aids may be useful is indicated. Their design is then considered. Theory indicated that, when speech signals have to be very loud in order to be distinguished, max. intelligibility can usually be expected if the amplification varies with frequency in a given way. Tests with a large number of deaf people confirmed this. The most useful amplification/frequency characteristics for a hearing aid are given. A.

612.85 : 534.792 : 534.83

375. The masking of tones by repeated bursts of noise. MILLER, G. A., AND GARNER, W. R. *J. Acoust. Soc. Amer.*, **20**, 691–6 (*Sept.*, 1948).—The masking of tones by continuous and interrupted noise was determined for three noise intensities, three noise-time fractions, and rates of interruption varying from 0·5 to 512 interruptions per sec. The decrease in masking effectiveness as a result of the discontinuity of the masking noise depends principally upon the duration of the silent interruption, and secondarily upon the frequency of the masked tone and the intensity of the noise. A computational device is presented which will permit a first approximation of the masking produced by interrupted noises. A.

612.858.71

376. The Massachusetts hearing test. JOHNSTON, P. W. *J. Opt. Soc. Amer.*, **20**, 697–703 (*Sept.*, 1948).—A combination speech-pure tone group test technique is described in which standard phonograph speech audiometer equipment is readily converted for dual test use through the addition of a commercial discrete frequency audiometer and an inexpensive coupli unit. The group pure tone section of the test rapidly scored and is shown to possess a mark superiority over the phonograph record test in ter of correlation with individual pure tone test criteria.

613.63 : 771.534

377. Roentgen-ray calibration of photographic fil exposure meter. DEAL, L. J., ROBERSON, J. H., AN DAY, F. H. *Amer. J. Roentgenol. Radium Ther.*, **5** 731–6 (*May*, 1948).—Tests were made on a fil intended to be carried by operators to detect stra radiation in the neighbourhood of an atomic pil The film is carried in a light metal container witho Pb backing and one half is screened from β-rays b 1 mm of Cd. Using X-rays, both films were foun to be independent of radiation quality above 400 kV but a max. density is produced by 200 kV radiatio giving a false impression of the severity of th exposure. Measurements made with a pock ionization chamber are also reported; this showe similar variations, and the consistency of the reading was not satisfactorily established. B. J. I

615.84

378. Dosage determinations with radioactive isotopes II. Practical considerations in therapy and protection MARINELLI, L. D., QUIMBY, E. H., AND HINE, G. J *Amer. J. Roentgenol. Radium Ther.*, **59**, 260–81 (*Feb* 1948).—Dosage calculations are complicated, as these isotopes are usually ingested, and eventually excreted Practical methods are given for calculation of re stricted β-ray and γ-ray dosage, safe concentration of tracers, distribution in the tissues and effectiv $\frac{1}{2}$-life. Values are given for P^{32}, Sr^{89}, Ca^{45}, Na^{22}, K^{4} and I^{130} B. J. L

615.84

379. Radioactive needles containing cobalt 60 MYERS, W. G. *Science*, **107**, 621 (*June* 11, 1948).— Wires have been prepared for radio-therapeutic use by the irradiation of a Co/Ni alloy containing 55% Ni in a pile These show uniform linear activity A wire 3 cm long, 1 mm dia. showed activity of $\frac{1}{2}$-valu layer 0·41" Pb, equivalent to 4·08 mg of Ra. Animal experiments show the need for filtration to remove β-rays. The wires can be handled with an electro-magnet, machine easily, and can be bent to fit tumour shape. Clinical evaluation will shortly be undertaken. H. M.

616.073

380. Recording of the movements of the gastric organs by means of cinedensography. MARCHAL, M. *C.R. Acad. Sci., Paris*, **226**, 1322–4 (*April* 19, 1948) *In French.*—A previous paper [Abstr. 3265 (1946)] dealt with heart movements recorded by means of photo-electric cells placed on the edge of the X-ray shadow. This technique has now been extended to the observation of movements of the stomach and diaphragm. Peristaltic movements of the stomach independent of diaphragm movements can be observed. The method can be used to detect defects in the mobility of selected portions of the stomach wall. J. E. R.

GLASS . CERAMICS 666

666

381. Physics in glass technology. MOORE, H. *Rep. Phys. Soc. Progr. Phys.*, **11**, 342–56 (1946–47).—An account of the applications of physical analytic and control methods in glass manufacture and technology, especially in the manufacture of refractories, glass melting, furnace design, annealing processes and testing of product. The importance of physical methods in more fundamental studies of glass structure is also discussed. G. O. J.

PHOTOGRAPHY 77

77.012

382. New data on the nature of photographic sensitivity. CHIBISSOV, K. W., TITOV, A. A., AND MIKHAILOVA, A. A. *C.R. Acad. Sci. URSS*, **54** (*No.* 8) 709–12 (1946) *In English.*—An investigation was made into the nature of local imperfections in the grains of a photographic emulsion, assuming the imperfections were formed during the preparation of the emulsion itself. The amount of Ag ions interacting with the gelatine, and the amount of AgS formed during the heating of a mixture of solutions of gelatine and $AgNO_3$ in water were determined; an estimation was made of the Ag not bound by the halogen and of the AgS on the surface of the microcrystals of the photographic emulsion. The results are used to set up a theory of photographic sensitivity. L. S. G.

771.319 : 522.61

Recent advances in astronomical camera design. *See Abstr.* 13

771.35 : 535.317.25

383. The effect of imperfect light ray convergence on photographs. HUBER, S. *Z. InstrumKde*, **63**, 333–41 (*Oct.*); 369–83 (*Nov.*, 1943) *In German.*—An experimental and mathematical investigation of the effect of imperfect light-ray convergence, due to the various typical small lens defects, on the resolution, contrast, etc., of photographs. A high-power special Zeiss lens was used for the experiments which are described in detail. The test object consisted of a configuration of alternate dark and light lines, and the resolving power of photographs with various aperture stops, distances, etc., can thereby be determined, and the experimental results compared with calculations. V. W. R.

771.351 : 666.22

384. The effect of high index glasses on the field characteristics of photographic objectives. AKLIN, G. H. *J. Opt. Soc. Amer.*, **38**, 841–4 (*Oct.*, 1948).—Improving field characteristics of photographic objectives has always been the concern of the lens designer. Progress has followed the introduction of glasses with high index and low dispersion. These new glasses have been used in the collective lenses in such a manner as to increase the index difference between collective and dispersive elements. This has the effect of basically moving both tangential and sagittal focal points closer to the focal plane throughout the zonal portions of the field, improving Petzval sum, and increasing covering power. Variations of zonal corrections and covering power with these basically improved characteristics are discussed. A.

771.37

385. Method of adjusting picture definition. KORFF, G. *Z. InstrumKde*, **63**, 121–5 (*April*, 1943) *In German.*—Describes a method of focusing a camera lens system exactly on an object which eliminates uncertainties due to depth of focus of the lens. A special test object is used consisting of a ground glass screen having 2 ruled gratings placed at some distance on alternate sides. When the ground glass screen is exactly in focus all the lines are visible; if out of focus the number of lines appears to be halved. The author gives the theory of the method and calculates the various relevant dimensions. V. W. R.

771.534.1

386. The influence of static pressure on the sensitivity of photographic emulsions. II. BÄCKSTRÖM, H., AND ADELSOHN, O. *Ark. Mat. Astr. Fys.*, **35 A** (*Paper* 21) 40 *pp.* (1948) *In English.*—A continuation of the work described previously [Abstr. 2637 (1948)]. It is shown that the observed pressure effect is complex and consists in (1) a photochemical effect of static pressure applied to the emulsion, (2) an optical effect inherent in the method employed—heavy pressure causing optical contact between emulsion surface and protecting glass: as a result, more light is lost by scatter from Ag halide crystals within the pressurized area of emulsion than elsewhere. It is not possible to eliminate effect (2), but (1) and (2) may be studied separately, and agreement with theory is found. Both pressure and temperature influences on the photochemical activity of normal emulsions are caused by a decrease of electrical conductivity of Ag halide crystals. Thus, for high intensity exposures of short duration, heavy pressure and low temperature act similarly to produce a lowered developed density; whilst, at low intensity, their effects are dissimilar. D. R. B.

771.534.562 : 541.18

387. Note on the theory of the photographic effect of intermittency. ZACHOVAL, L. *Čas. Pěst. Mat. Fys.*, **72** (*No.* 3) 161–75 (1947) *In French.*—The theory presented is based on physical conceptions of the intermittent effect. The reasons justifying the disregard of chemical processes are given. A simplified emulsion is defined and considered, and the conditions of validity of the theory are stated. The author deduces the fundamental equations governing the growth of the number of developable grains in the simplified emulsion. The results are compared with experimental data. The applicability to real emulsions of results obtained for a greatly simplified emulsion is pointed out. A.

771.535 : 541.148

388. Herschel effect for different levels of illumination in the pre-exposure. MEIKLYAR, P. B. *C.R. Acad.*

Sci. URSS, **54** (*No.* 8) 705–7 (1946) *In English.*—An experimental study of the weakening of the latent image by red light at different levels of illumination. It is shown that this weakening is related to the decrease in the photographic action of light with decrease in the level of illumination. Two latent images can be different according to the level of illumination under which they are formed, even if the same density is produced in the photographic layer after development. Present experimental results are compared with those of Webb and Evans [Abstr. 261 (1939)]. L. S. G.

771.535.01

389. Study of latent-image formation by a double-exposure technique. II. Internal image. BERG, W. F., AND BURTON, P. C. *Photogr. J.*, **88 B**, 84–8 (*July–Aug.*, 1948).

772.11/.19 : 539.26

390. Röntgenographic observation of the ripening of silver bromide emulsions. BURGERS, W. G., AND KOOY, J. N. *Rec. Trav. Chim. Pays-Bas*, **67**, 11–15 (*Jan.*, 1948) *In English.*—Debye-Scherrer patterns of AgBr emulsions taken before and after the first and second ripening process of the emulsion at 40°C show an increased resolution of the CoK_α doublet of the AgBr-line $\Sigma(H^2 + K^2 + L^2) = 40$ after the first ripening stage. The result is in agreement with the concept that crystal growth during the first stage of ripening takes place before the soluble salts have been eliminated by rinsing. R. H. H.

778.3 : 535.247.1

Photographic photometry. *See Abstr.* 151

778.33 : 539.166.93

391. Exposure chart for radium radiography. ISENBURGER, H. R. *Metal Progr.*, **52**, 640 (1947).—The variation of exposure with thickness of steel, for a film density sufficient to give full details and a specified film arrangement, is shown graphically. Ra source-to-film distances for 5 types of film are tabulated and a correction is given for temp. changes. B. A.

778.33 : 615.

392. Radioautography. MARINELLI, L. D., AN HILL, R. F. *Amer. J. Roentgenol. and Radium The* **59**, 396–403 (*March*, 1948).—With the extending u in therapeutics of radioactive elements introduced in the body by ingestion, or injection, it becomes importance to determine the distribution of t material in the various tissues of the body. This c be effected in suitable cases by measurement of t degree of blackening of a photographic film expos to an histological section of the particular radioacti tissue. A formula based on the Bunsen–Roscoe la is derived relating quantity of radiation, amount p unit area of the section, decay constant, ½-life the element and exposure time, irrespective of t type of radiation. An apparatus is described f measuring the amount of element per unit area, terms of a known quantity of the radioactive eleme used for calibration. Its application to actu histological specimens, such as thryroid tissue co taining radioactive iodine and tissues containi radioactive phosphorus, is discussed. The use faster photographic material is indicated if the meth is to have wide application but, in general, it shou be limited to patients undergoing therapy with radi active elements. B. J.

778.38 : 513.761

393. Affine picture transformation by means picture distortion correctors. TRAENKLE, C. *Z. InstrumKde*, **64**, 90–6 (*April–June*, 1944) *In Germa* —Picture distortion correctors are used to re-proje and correct aerial photographs taken at a slig inclination from the horizontal. The relation betwe the stretch and shift of an area in affine pictu transformation is found to be a circle diagram simil to the well-known Mohr stress circle. The ma possible deformation possible by a single projecti operation in a given picture distortion correct apparatus is investigated. This can be applied correct contractions of aerial maps and to affi deformation of networks. Experiments corrobora the theory developed. V. W.